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GEOGRAPHICAL AFFINITIES OF THE MAMMALS OF THE HAWAIIAN ISLANDS AND OF NEW ZEALAND

BY DAVID H. JOHNSON

In a recent article, Dr. Ernst Mayr (1943) has analyzed the avifauna of the Hawaiian Islands and demonstrated that most of the native land birds are of North American rather than Asiatic or Australian origin. It is interesting to subject the more meager but perhaps equally significant mammalian fauna to the same sort of inspection, and in addition to point out certain resemblances it bears to the distant and similarly isolated fauna of New Zealand.

On the basis of the aboriginal human inhabitants, both these island groups are viewed by ethnologists as peripheral components of the vast oceanic area known as Polynesia. The well established fact that the Polynesians are of Asiatic origin may in part be responsible for the general impression that the Polynesian fauna is likewise primarily Asiatic. Mayr has convincingly shown that this is not true of the Hawaiian birds, and the evidence here assembled concerning Hawaiian and New Zealand mammals indicates that they too are basically non-Asiatic.

In the late eighteenth century, prior to the disturbances brought about by the activities of Europeans in deleting native species and adding exotic ones, the mammals of these islands belonged to three groups: (1) bats, (2) seals, and (3) man and the species he had imported. In addition, the adjacent seas were inhabited by various pelagic cetaceans, none of which is significant in the present analysis.

HAWAIIAN MAMMALS

Lasiurus semotus H. Allen, the Hawaiian bat, of American origin. Bats of this genus are common on the American mainland but do not occur in the Old World. The more northern species at least are known to be highly migratory (Miller, 1897); migrating individuals have been seen about ships far out at sea (Thomas, 1921); and in addition to the Hawaiian group such distant islands as the Bermudas and the Galapagos have been colonized (G. M. Allen, 1923; J. A. Allen, 1892).

Monachus schauinslandi Matschie, the Laysan seal, a species restricted to the Hawaiian Islands proper and to the chain of reefs extending westward some 1,300

miles to Midway and Ocean (or Kure) Islands. The two other representatives of the genus are restricted to opposite shores of the Atlantic; they are *Monachus monachus* of the Mediterranean and *Monachus tropicalis* of the Caribbean area. G. M. Allen (1942, p. 456) suggests a derivation of the Laysan seal from the Caribbean in Tertiary times prior to the establishment of the Panamanian land barrier separating that area from the Pacific Ocean. In the absence of more concrete evidence as to its origin, this species cannot be considered a reliable faunal indicator.

Homo sapiens Linnaeus, the Polynesians, of Asiatic origin, who arrived in boats of their own making by way of oceanic islands toward the south or west, probably in the eleventh or twelfth centuries A. D. (For a recent summary of Polynesian migration see Weckler, 1943.)

Rattus hawaiiensis Stone, the Hawaiian rat. This is the northeasternmost representative of a widely distributed group of small rats typified by *Rattus concolor* of Burma. Members of the group have been carried, probably by accident, from island to island over most of the Pacific area in the boats of the Polynesians, and it was undoubtedly by this means that rats reached the Hawaiian Islands (Miller, 1924).

Canis familiaris Linnaeus, the domestic dog, carried purposefully by the Polynesians in their migrations.

Sus sp., a domestic pig, likewise introduced by the Polynesians.

It is interesting to note that each of the six Hawaiian species represents a different mammalian order, and that immigration was by such diverse means as flight, swimming, navigation, accidental stowing away, and intentional transport by man.

NEW ZEALAND MAMMALS

Mystacops tuberculatus Gray, a bat that has no known relatives. It is currently classified as the sole member of the family Mystacopidae, a group that appears to have affinities with the cosmopolitan families Vespertilionidae and Molossidae (Miller, 1907, pp. 239–241).

Chalinolobus tuberculatus Gray, a bat belonging to a genus that is well represented on the Australian continent and is known to occur also on New Caledonia (Revilliod, 1914, pp. 355–357) and on Norfolk Island and possibly Lord Howe Island (Troughton, 1920 and 1922). In morphological characters as well as in its demonstrated ability to cross broad expanses of open ocean, *Chalinolobus* somewhat resembles the American and Hawaiian *Lasiurus*.

Arctocephalus forsteri Lesson, the New Zealand fur seal, closely allied to the fur seals of the Tasmanian and Australian coasts. The genus *Arctocephalus* has a southern circumpolar distribution with a lateral branch extending northward along the eastern shore of the Pacific Ocean to California.

Otaria cinerea Péron and Lesueur, a sea-lion representing a southern circumpolar genus.

Mirounga leonina Linnaeus, the southern elephant seal, a southern circumpolar form with a related species on the western coast of North America.

Lobodon carcinophaga Hombron and Jacquinot, the crab-eating seal, typically restricted to the Antarctic pack-ice but occasionally appearing as a straggler on the coast of New Zealand (Oliver, 1921).

Hydrurga leptonyx Blainville, the leopard seal, a northward straggler from the Antarctic, record by Gray (1874, p. 87).

Leptonychotes weddellii Lesson, the Weddell seal, another straggler from the Antarctic (Bertram, 1940, pp. 5–6). Still a fourth Antarctic seal, *Ommatophoca rossi*, might reach New Zealand as a straggler, but apparently there are as yet no published records of such an occurrence.

Homo sapiens Linnaeus, the Polynesians, of a subgroup known as Maoris, who arrived by voluntary migration from the northward lying Cook and Society islands. The date of the first real colonization of New Zealand by Polynesians has been estimated at about the year 1350 A. D., although legends indicate that there were earlier exploratory trips (Archey, 1937, pp. 5–6).

Rattus maorium Hutton, the Maori rat, which like the Hawaiian rat is a member of the *Rattus concolor* group and likewise arrived with the Polynesians. This rat is only doubtfully distinct from *Rattus exulans* of the Society Islands (see Thomas, 1895).

Canis familiaris Linnaeus, the domestic dog, brought in by the Polynesians. Apparently the Polynesians never succeeded in bringing the pig to New Zealand.

For a more graphic presentation the genera of the two islands and their geographical affinities may be tabulated as follows:

	HAWAIIAN ISLANDS		NEW ZEALAND	
Bats	*Lasiurus*	American	*Mystacops*	Endemic
			Chalinolobus	Australian
Seals	*Monachus*	Atlantic	*Arctocephalus*	Circumpolar
			Otaria	Circumpolar
			Mirounga	Circumpolar
			Lobodon	Antarctic
			Hydrurga	Antarctic
			Leptonychotes	Antarctic
Man and his importations	*Homo*	Asiatic	*Homo*	Asiatic
	Rattus	Asiatic	*Rattus*	Asiatic
	Canis	Asiatic	*Canis*	Asiatic
	Sus	Asiatic		

The respective mammalian faunas of the Hawaiian Islands and New Zealand agree in their essential composition. The bats in each instance, so far as can be determined, are derived from the nearest continent, whereas the less land-bound seals belong to groups whose distribution is conditioned by environmental factors correlated with latitude. Neither bats nor seals indicate an affinity with the Asiatic mainland or with the Indonesian and Melanesian islands. The Asiatic element in these peripheral Polynesian islands has resulted entirely from human migrations within the last millenium. Somewhat the reverse situation prevails in the central Polynesian islands, such as the Samoan group, where American

and Australian elements are lacking and Asiatic bats of the genera *Pteropus* and *Emballonura* are present.

LITERATURE CITED

ALLEN, GLOVER M. 1923. The red bat in Bermuda. Jour. Mamm., vol. 4, no. 1, p. 61.

———— 1942. Extinct and vanishing mammals of the western hemisphere, with the marine species of all the oceans. Amer. Comm. Internat. Wild Life Protection, Special Publ. no. 11, pp. xv + 620, illus.

ALLEN, J. A. 1892. On a small collection of mammals from the Galapagos Islands, collected by Dr. G. Baur. Bull. Amer. Mus. Nat. Hist., vol. 4, no. 1, pp. 47–50.

ARCHEY, GILBERT. 1937. South Sea folk. Handbook of Maori and Oceanic ethnology. Auckland War Memorial Mus., pp. 59, pls. 11.

BERTRAM, G. C. L. 1940. The biology of the Weddell and crabeater seals, with a study of the comparative behaviour of the Pinnipedia. Sci. Repts. British Graham Land Exped. 1934–37, vol. 1, no. 1, pp. 1–139, figs. 42, pls. 10.

GRAY, J. E. 1874. List of seals, whales, and dolphins of New Zealand. Trans. New Zealand Inst., vol. 6, pp. 87–89.

MAYR, ERNST. 1943. The zoogeographic position of the Hawaiian Islands. Condor, vol. 45, no. 2, pp. 45–48.

MILLER, GERRIT S., JR. 1897. Migration of bats on Cape Cod, Massachusetts. Science, n. s., vol. 5, no. 118, pp. 541–543.

———— 1907. The families and genera of bats. U. S. Nat. Mus. Bull. 57, pp. 282, figs. 49, pls. 14.

———— 1924. The characters and probable history of the Hawaiian rat. Bernice P. Bishop Mus., Bull. 14, pp. 2–6.

OLIVER, W. R. B. 1921. The crab-eating seal in New Zealand. Trans. New Zealand Inst., vol. 53, p. 360, pl. 56.

REVILLIOD, PIERRE. 1914. Les mammifères de la Nouvelle-Calédonie et des îles Loyalty. *In* F. Sarasin and J. Roux, Nova Caledonia, Zoologie, vol. 1, pt. 4, no. 9, pp. 340–365, pl. 10.

THOMAS, O. 1895. Pacific rat (*Mus exulans*). Proc. Zool. Soc. London, 1895, p. 338.

———— 1921. Bats on migration. Jour. Mamm., vol. 2, no. 3, p. 167.

TROUGHTON, ELLIS LE G. 1920. Notes on Australian mammals. No. 1. Records Australian Mus., vol. 13, no. 3, pp. 118–122, figs. 5.

———— 1922. Notes on Australian bats, and the occurrence of *Chalinolobus gouldii*, Gray at Norfolk Island. Australian Zoologist, vol. 3, pt. 1, pp. 39–41.

WECKLER, J. E., JR. 1943. Polynesians, explorers of the Pacific. Smithsonian Inst. War Background Studies, no. 6, pp. iv + 77, pls. 20.

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TROPICAL MAMMAL TRAPPING I: THE WATER MOUSE RHEOMYS

By R. A. Stirton

Trapping mammals in the tropics is considered by all collectors as a difficult task. It richly deserves the reputation it has received. Anyone who has run a trapline in Tropical America to find trap after trap not disturbed, with bait missing, sprung by the rain, wind or other agencies, only to find an occasional mouse partly or wholly skeletonized by the ever present hordes of ants, has some idea of the problems to be encountered. It seems important, therefore, for those of us who have been exposed to these conditions to outline some of the trapping methods that we have developed through days and weeks of provoking experiences.

These notes will deal with the two species of water mice *Rheomys thomasi* Dickey and *R. stirtoni* Dickey which were described from El Salvador, Central America, by Donald R. Dickey (1928). Except for the rounded and somewhat hairy tail *Rheomys* looks much like a miniature model of the beaver. Specimens of the genus are, for the most part, rare in collections. Only five species (Ellerman, 1941, p. 483) are now known, one each from Colombia, Panama, and Costa Rica, and two from El Salvador. It is possible that at least some of these should eventually connect up through intergrading subspecies, for there is much suitable territory for them in the headwaters of hundreds of streams in Central America and Colombia. It is hoped that these notes may aid collectors in securing series from the intervening areas.

My earliest instruction from a former associate, C. D. Bunker, on collecting mammals in a new and unknown area was "always place at least a few traps in spots normally not occupied by mammals to catch the rare genera." This resulted in the taking of my first *Rheomys* specimen. It was late in November 1925 at Finca San Felipe on Mount Cacaguatique, while putting out a trap line along the edge of the Arid Lower and Arid Upper Tropical zones (Dickey and van Rossem 1938, pp. 42–48) that I noticed a small drift of dried twigs and leaves that had partly blocked a small stream not more than two hundred yards from its seepage source from the base of a high cliff of volcanic breccia. At one place a bit of the stream passed over the drift, this was a space not more than three inches wide, most of the current passing under. Here the Bunker principle was applied. A small snap trap (Museum Special) baited with oatmeal was placed on the drift at the waters edge where the water flowed over. This was done not so much with the idea of catching an aquatic animal but with the thought that some species might be occupying these small drifts.

On the following morning the trap had an immature *Rheomys*. Of course I then realized that the drift was only incidental to the taking of this mouse, for it was truly an aquatic form and in all probability crossed over the drift at this point instead of attempting to dive under. The trap was reset and another placed on the drift at the opposite edge of the overflow. On the two succeeding mornings these two traps either held *Peromyscus mexicanus salvadorensis* Dickey

or had been sprung and dragged out of position, but since they had been tied securely were not lost. Large snap traps were then placed in the same spots but these succeeded only in eliminating more *Peromyscus* or were not disturbed. Then in attempting to get away from the *Peromyscus* one large snap trap was forced down into the drift over which the water flowed, thus the back end of the trap was out of water but the treadle was nearly parallel with the surface so that

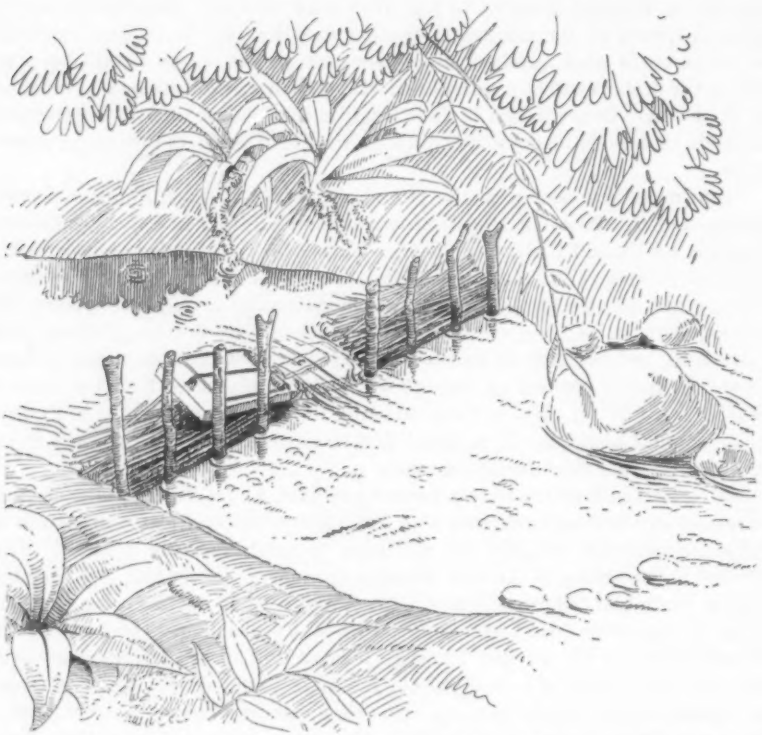

FIG. 1. An illustration showing an artificial obstruction and the proper setting of a large snap-trap for the taking of *Rheomys* under ideal conditions.

the water partly flowed and partly splashed over it. The current was not strong enough to dislodge the trap.

This set secured an adult *Rheomys*. The Museum Special was a bit too light for these sturdy little creatures. Then I set about to improvise other similar obstacles where traps could be placed in the water path of these mice or to direct the mouse over the treadle of the trap. Other drifts were made by pushing sticks into the mud of the stream bottom then lodging sticks and trash in above the stakes (fig. 1). It was always necessary to insure the passing of most of the current under the drift so that the trap would not be floated out of position.

PLATE 1

Rheomys thomasi Dickey in a cool shady stream strewn with andesitic rocks and with a decaying branch at the waters edge. Natural size. Drawn by Owen J. Poe from wet specimens and a dry skin.

PLATE 2

UPPER: Near the type locality of *Rheomys stirtoni* Dickey, 8000 ft., Humid Upper Tropical life zone—Los Esesmiles, Department Chalatenango. Here the canyon was deep with heavy cloud forest vegetation on both sides. Large oaks laden with orchids and other epiphytic plants, wild avocados, tree ferns, and other plants covered the steep slopes.

LOWER: A water set without camouflage for *Rheomys thomasi* Dickey on the north slope of Mount Cacaguatique, Department San Miguel. Note the position of loose rocks to direct the animals over the trap treadle. Lens pointed down stream.

In places where the stream bottom was bedrock, rocks were used to block the stream. This is sometimes quite difficult since more of the current is blocked and the trap is likely to float or be disturbed. Usually a rock can be pressed against both the front and back edges of the trap thus wedging it into position. Care should be exercised, however, so that it will spring through its arc free of obstacles. Insufficient caution in this matter resulted in the loss of several specimens. It is always advisable not to be hasty in making the sets.

In my last days of trapping for *Rheomys* at Los Esesmiles (March 26–28, 1942) I observed that the five specimens taken were headed up stream when caught. This might be significant and should be borne in mind when making a set. My field notes did not cover this point on the numerous specimens from Mount Cacaguatique.

The trap can best be camouflaged by thin-textured water-soaked leaves. In the tropics there is usually an abundance of the kinds desired. After the trap is wedged into position, and by holding the trap so it cannot trip, a leaf may be lowered into the water on the upstream side. As the current whips the lower half of the leaf under, the remainder can be flipped over the trap below the treadle concealing that part of the trap. Other smaller leaves or pieces of leaves may be used in a like manner to cover the treadle, jaws and springs. Only a small quantity of this material should be used, otherwise it will interfere with the action of the trap. Pieces of banana leaves were sometimes used in this process. That it is necessary to exercise this extra precaution might be questioned, but the camouflaged traps were the most successful. It was found undesirable to bait the traps since this had a tendency to attract *Peromyscus* and *Oryzomys*.

These methods in trapping small aquatic mammals should be equally successful in securing series of the South American genera *Ichthyomys*, *Anotomys*, *Neusticomys*, and *Daptomys*. A series of the water shrew, *Sorex palustris navigator* (Baird), was taken in Fish Lake Valley, Nevada, by making similar sets with the Museum Special mouse traps.

HABITATS

Because of the nature of the project it was not possible to spend the time necessary to obtain ecologic data in full, but there were some observable differences in the habitats of the two species which are here treated separately.

Rheomys thomasi was first encountered on the southwestern slope of Mount Cacaguatique (Finca San Felipe—type locality) near the contact of the Arid Lower Tropical and Arid Upper Tropical life zones (Dickey and van Rossem 1938, pp. 42–48). As outlined by the plants, the lower zones extended up the ravines and the upper zone carried down the ridges in an interfingering pattern. Here the water mice seemed to be restricted to the Arid Upper Tropical (Temperate of some authors) at an elevation of 3500 feet, although it should be borne in mind that the original plant associations have been partly disturbed by the cultivation of coffee. Sixteen years later we trapped them on the north side of the mountain (Finca San Carlos) between the altitudes of 4300 and 4700 feet. Here again, coffee planting interferred with the tracing of the original plant zones. But it seems that the problem to be decided on the north slope is—were they

formerly restricted to the Arid Upper Tropical or to the Humid Upper Tropical that extended down the ravines on this side of the mountain. Perhaps a critical examination of the specimens will throw some light on the matter.

This species was found in cool, shady streams not more than three or four hundred yards from their source. These little streams, across which one could step at almost any place, usually ran through the coffee, but frequently they flowed through bush thickets only to meet again with coffee, banana groves or corn patches. Possibly farther down stream it is a bit too torrential during the rainy season for the nocturnal activities of these little animals. For the most part, the streams were strewn with andesitic and brecciated boulders ranging up to two feet in diameter. These were partly buried by a foot or more of alluvium, which were deposited above fallen banana trees or other obstacles inhibiting erosion. There were little pools, currents, relatively quiet stretches of water and even miniature falls. In some places the current passed partly under low root restraining banks, and again under trash and other accumulations of fallen and decaying vegetation. There was less obstruction to the streams and the water was clearer on the southwestern slope than on the more humid northern slope.

Rheomys stirtoni occurred at an elevation of 8000 feet in the cool, almost cold, Humid Upper Tropical life zone on Los Esesmiles, Department Chalatenango. The type and all other specimens were taken in the stream that flows north from the gap between the two peaks. Here the canyon was deep, with heavy cloud forest vegetation on both sides. Large oaks laden with orchids and other epiphytic plants, wild avocados, tree ferns and many other plants covered the steep slopes. Only tiny spots of sunlight were seen here and there on the dripping ferns or on the moss-covered walls of decomposing andesite. The ground was always wet even in the dry season. This stream was larger than those at Mount Cacaguatique, averaging about three feet in width. The pools were larger, much deeper and some of the falls were 10 to 12 feet high. Likewise, the stream was clearer, with more stones and even huge andesitic boulders; along certain stretches it was almost impossible to follow the water course because of the dense plant growth and steep wet banks. Traps set in the smaller tributaries farther up stream did not catch this larger mouse. Possible nesting sites could have been in dead brush and logs lodged in the stream or even greater shelter and protection would have been afforded under the larger boulders and other rocks. No specimens were taken at 7000 and 7500 feet in places seemingly well suited for the occupation of water mice, though many sets were made. Farther down, the Arid Upper Tropical life zone of this region was too dry to give us a representative from that zone. The only specimens taken were found in the deepest recesses of the diminishing cloud forest.

FOOD HABITS

We discovered no evidence of the El Salvador species being piscivorous, although the genus *Rheomys* has been included with the cricetine group of fish-eating rats. Most of the stomachs examined were empty but the few that contained food gave evidence of an omnivorous diet and even cannibalism. Partly

digested food from the Mount Cacaguatique specimens was identified as white starchy pulp, finely ground pieces of insect tests—possibly backswimmers (*Notonecta ceres stirtoni* Hungerford) which were common in the streams. One *Rheomys* that had been caught by the tail had been attacked, possibly by one of its own kind, the skin had been cut in several places, and the animal was nearly dead. Another specimen taken in the same stream had hair and flesh in its stomach. The hair was like that of *Rheomys*. On the previous night a water mouse had been caught in the same trap and eaten; only the hind feet remained in the trap. Evidently these mice are attacked and even eaten by their own kind when held but not killed by the trap.

The stomach content of those from Los Esesmiles contained a white starchy substance, a dark pink stained pulp possibly blackberry, bird feathers and flesh—probably, but not certainly, referable to the rufous-browned wren (*Troglodytes r. rufociliatus* Sharpe), and bones and flesh of the little salamander *Oedipus*. Two salamanders were found in the *Rheomys* stream, one on a rock and the other on a clump of orchids that had blown out of the trees and lodged in the stream. This was early in the morning. The skins of the salamanders were dry indicating that they had been out of the water for some time.

LITERATURE CITED

DICKEY, D. R. 1928. Five new mammals of the rodent genera *Sciurus*, *Orthogeomys*, *Heteromys* and *Rheomys*, from El Salvador. Proc. Biol. Soc. Wash., vol. 41, pp. 11–14.

DICKEY, D. R. and A. J. VAN ROSSEM. 1938. The birds of El Salvador. Publ. Field Mus. Nat. Hist., Zool. series vol. 23, pp. 21–23, 31–52.

ELLERMAN, J. R. 1941. The families and genera of living rodents. British Mus. London, vol. II—Family Muridae, p. 483.

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ON THE WINTER TRAPPING OF SMALL MAMMALS

By J. Dewey Soper

The trapping of small mammals for scientific purposes is being reduced to a science with greater refinements as time goes on. Fortunately, several publications have appeared on field taxidermy and collecting that contain excellent directions for attaining these ends. All such instructions that have come to my attention, however, obviously refer for the most part to summer trapping. The very nature of the work is such that the great majority of specimens has been and will continue to be taken from spring until fall. General technique is based on this circumstance for many reasons of expediency.

No single paper to my knowledge is exclusively devoted to general methods for the trapping of small mammals during the colder months when snow covers the ground over the greater part of North America. Comparatively little winter trapping has been conducted for museum material, but, as anyone will agree, it is desirable to have cold weather series of the smaller mammalia representing true winter pelage. It is believed that museums in general are woefully poor in small mammals collected in the higher latitudes at this time of the year. The purpose of this paper is to provide a few hints on this type of trapping arising out of personal experiments at various times. These may be of some value to those who desire to engage in similar activities to acquire better balanced and more valuable collections.

At the outset it is clear that winter trapping has its limitations. Fewer species are available for capture owing to the fact that many kinds of small mammals hibernate. Further, in comparison with summer, various handicaps make more difficult the taking of those species that remain more or less active all winter. On the whole, specimens are acquired much more slowly and with greater exposure, discomfort, and expenditure of energy on the part of the collector than at any other time. Nevertheless, the scientific knowledge thus gained in regard to pelage, habits and activities is unquestionably worth all the effort expended. It is needless to point out that the collector is not necessarily obliged to carry out all such work during the bitterest part of the winter, but may profitably engage in it during the milder weather that prevails early and late in the season.

Despite the radical change in field conditions, basic procedure largely follows the pattern of summer trapping. Naturally there are certain modifications. In principle, traplines are laid out in much the same way, but they are usually easier to follow because of guiding tracks in the snow. Nevertheless, all traps should be plainly marked; heavy snowfalls which may easily obliterate most, if not all ordinary signs, are likely to occur at various times. Fifty, 60, or more traps can well be used at this season. As to the extent of trapline employed, much will depend upon general "sign," type of country, etc., but, per 50 traps, it will normally vary from a quarter to a half-mile in length. Ordinarily this may be in the form of a wide circle, or several radiating lines from headquarters. If in a forested region, the line can be lightly blazed on trees with a small axe, with

special marks at each trap. When following a frozen stream, broken willows or alders, or blazes on trees conspicuously show the location of sets along the banks. As in summer, all life-association areas should receive attention by bodily shifting all or part of the trapline from time to time. As investigations progress, one may go increasingly farther afield.

In winter collecting, the same types of traps are used as at other periods. The majority will consist of the "Museum Special"—a trap somewhat larger than an ordinary mouse trap, but with a striker spring of similar strength. For summer use, the wooden bases of these are normally waterproofed with hot wax, or shellac; in winter trapping extra care is necessary to see that moving parts are not clogged with these substances, as freezing temperatures make such parts increasingly stiffer and harder to set off. In some cases the rat-size counterpart of the mouse trap may be employed, as for red and flying squirrels and sometimes the smaller weasels. In the long run, however, better success is achieved with these species at baited cubby or other sets using the standard No. 0 steel trap.

In the early part of the season before the snow becomes very deep, shrews of several species are comparatively active on the surface. In the woods they sometimes make well beaten trails in the snow, usually from hole to hole, or from one mass of litter to another. Traps embedded crosswise of these trails are frequently productive. Good sets can also be made in depressions under logs. In the depths of the forest where little wind prevails, a narrow strip of bare ground often persists in such places for a few weeks when adjacent areas are covered with several inches of snow. The animals habitually use these sheltered strips, because of the cover and easier travelling conditions; when resident at such points, they may be easily captured.

Later in the winter when the snow is everywhere deeper, shrews seldom come to the surface. At this time I have succeeded in taking a few by digging to ground level under logs, windfalls, and at the bases of trees and setting traps in the bottoms of the trenches (fig. 1a). This is laboring in a state of difficulty and uncertainty, but specimens are occasionally obtained. Under most circumstances it appears best to make the narrow trench at least three feet long with two or three traps set along the bottom; if trapping in coniferous forest, the whole may be covered over with a thatch of spruce or balsam boughs to exclude fresh snow.

The working principle here is that the trench that one digs down to the forest floor may intersect trails, or tiny tunnels in the leaves and humus, which are used by the animals. When this happens, they make a break through into the trench and are soon attracted to the baited traps. Of course, much depends upon a wise choice of location, a sense for which is gained largely from summer trapping experience. The outcome, however, is too often fruitless. Bait may consist of bacon or other meat, dried smoked fish, or a mixture of bacon grease and sardines. Oil of valerian has often been used, but I was never certain that this increased the catch. Incidentally, if one employs the leg bones in making up skins, great care should be used in removing specimens from traps in winter, as the legs are exceedingly brittle when frozen and easily broken. Especially is this true of the smaller *Sorex* and *Microsorex*. They are best carried to camp

cotton-wrapped in a small tin box. In the depth of winter, shrews are occasionally found dead on the snow without visible injury and consequently make good study skins.

Sometimes such small rodents as red-backed and white-footed mice can easily be captured by the same methods as described above. A notable difference with these creatures is the fact that at all times they are much more active on the

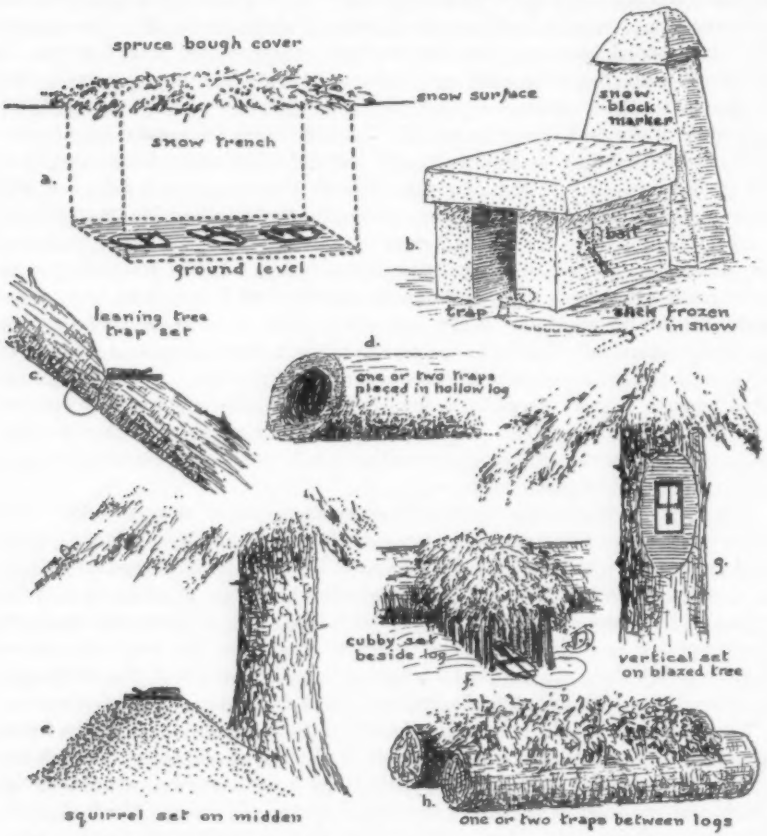

FIG. 1. Various trap sets that may be used in the winter trapping of small mammals

surface of the snow than shrews. This particularly applies to *Peromyscus* and *Clethrionomys*. Even when the snow is two feet deep, they frequently bore to the surface and make well-defined trails. Such activity is more prevalent during periods of moderate weather. Baited traps should be sunk somewhat in the trails near the entraces to the snow tunnels, preferably at each end of a well defined runway. In very cold weather the animals are much less active and sur-

face travel may be suspended completely, but on several occasions I have known them to emerge at −40°F, or even lower temperatures.

In forest trapping, one of the best sets is under fallen trees that lie three or four inches from the ground. Runways frequently exist in such places and traps set therein are shielded from falling snow; extra protection can be given to the set by placing strips of bark or a barrier of spruce boughs on either side. Runways sometimes come to the surface of the snow under cover of logs and sticks that protrude from the forest floor at a low angle; at the point of emergence is an excellent spot for a trap. Specimens have also been taken in hollow logs and holes in hillsides and river banks that have not been completely snowed in. Some of these are unused burrows of skunk and woodchuck. Even as late as March with snow at maximum depth in northern Alberta, many "white-foots" and "red-backs" have been captured in the depths of the forest by the above methods.

When operating from permanent quarters, it is quite feasible to prepare numerous sites for traps just before the beginning of winter. Such spots will be protected from snowfall and trapping may be carried on effectively at them for many weeks. One of the best of such prearranged locations consists of two logs placed parallel to and a few inches from each other and the space roofed over with evergreen boughs or slabs of bark. The resulting weather-proof tunnel is an excellent place for one or more traps (fig. 1h). Hollow logs can be located and marked for future reference to be used in the same way (fig. 1d). Many small, snow-free trapping sites can be made by driving short stakes into the ground to form hollow squares alongside of logs, stumps, or trees, and the whole well covered with spruce or balsam boughs. These should amply overhang all around in order to provide good protection to the ground underneath (fig. 1f). Hollows at the bases of decaying trees often make good trap sites for the smaller mammals, but many need to be supplemented with stake and bough construction in front before they are fully effective in excluding snow. Rocks can also be piled up to form canopied areas for the protection of mouse and other traps. The ingenuity of the collector will see many other ways and means of preparing winter trap sets with the materials at hand.

Several years ago in the far north I discovered that specimens could readily be procured in conjunction with snowshoe and toboggan trails. On such trails, which have been travelled several times, the snow becomes hard-packed on the bottom. It is apparent that this presents an obstacle to some small mammals whose ground runways it traverses; consequently, instead of going directly along the surface of the ground as before, they often detour vertically to the level of the hard trail, emerge, cross over, burrow into the soft snow wall on the opposite side and return to ground level. These tunnels are then regularly used for some time. Captures can be made at them by setting a trap at both openings. Traps should be off-set at the sides so as not to be interfered with by travellers.

A better procedure is to develop private snowshoe trails in different areas expressly for this kind of trapping. They should be tramped over repeatedly to level and consolidate the snow. The method is not very effective if the snow is much more than a foot deep; this depth permits good packing of the trail bot-

tom, which for the purpose in mind should not exceed four or five inches in thickness (fig. 2). Needless to say, all other types of trap sets may be employed along this trunk trail at the same time.

It may also be mentioned, in passing, that very often many specimens of native mice, shrews, etc., can be secured in abandoned forest cabins, old caches and storehouses and even in buildings that are in use. Deserted construction camps, and especially stables, are frequently a good source of material. All such places offer the advantage of getting the traps into dry areas free from snow at any time during the winter. In the mountains and foothills, the pack or wood rat (*Neotoma*) can be taken in some of these situations and occasionally specimens may be procured here with a light charge from a .410 shotgun in conjunction with an electric torch. It is also to be borne in mind that valuable series of odd skulls of furbearing mammals may be collected from discarded carcasses at trapper's cabins. By prearrangement with several men in a given wilderness area, hundreds of odd skulls, ranging from weasel to big game, could be obtained in this way if desired.

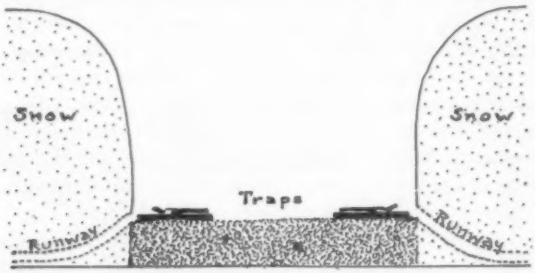

FIG. 2. A method of setting traps in toboggan or snowshoe trails

Experience shows that under some circumstances rodents can be captured without bait in winter, as in summer. That is, blind sets are made in narrow trails, with the traps placed crosswise, where the animals are caught while running over the treadle. It is firmly believed, however, that the best practise is to bait all traps, since it is certain that additional specimens are taken in this way. As an example, I have frequently made trail sets for *Microtus* with baited traps and unexpectedly secured various other rodents, shrews, etc., where the bait appeared to be directly responsible for their capture.

The same combination bait used in summer has been found attractive in winter. This is a mixture of bacon grease, cheese, peanut butter, finely-ground smoked summer sausage, honey and oatmeal; the ingredients are combined by heating and when cool should have the consistency of soft putty. Some other combinations are probably just as effective. Well ground bacon may take the place of summer sausage and various fish and meat sandwich spreads, now on the market, have been found very good alone or mixed with peanut butter, cheese and oatmeal. Usually a few drops of aniseed oil are added for use at any season and

it is believed to be somewhat more desirable in winter when the standard bait is less effluvious in a frozen state. In addition to the latter, a little oatmeal may be tossed on the treadle, with the likelihood of attracting some mice that are more or less indifferent to the paste bait.

It is well to mention at this point that the combination bait should be applied to the traps before leaving the warmth of headquarters. This results in less discomfort and greater speed of operation when once on the trail. Such a procedure is best even in summer by virtue of better organization and hence becomes of even greater importance in cold weather, especially in sub-zero temperatures. When loose cereal bait is used also, it will be necessary, of course, to sprinkle it on after the trap is set.

Use of the snow trench trap-set method, previously described, is not confined to forest locations. It also has been serviceable with varying degrees of success in meadows and muskegs. In such places many *Microtus* and a few *Synaptomys* and *Sorex arcticus* have been taken even late in the season when accumulation of snow was greatest. The method may also be used in likely places on the prairie. A small shovel is necessary in this type of trapping, for the snow may be fairly deep and the trench (approximately one foot by three feet) should be cut neatly all the way to the ground. A battery of three or four traps is set in the bottom and bedded on grass to keep them from freezing down. On one occasion a specimen was secured in every trap during a single night, denoting that it was a notably fortunate location. It is to be borne in mind that the disposition of such sets is naturally made "blind" and at random; results are a matter of chance, for no indication of the animals or their activities can be detected before or after excavation of the trench.

Except during fair weather with a steady barometer, all such trenches should be marked by upright sticks and roofed over to prevent filling in by drift or fresh snowfall. In a boreal forest region this is easily accomplished by covering with a few layers of spruce boughs. When working in the larger open tracts where evergreens are lacking, or inconveniently distant, another plan will have to be adopted. This consists of the simple expedient of roofing the trench with small slabs of snow; fortunately, because of wind action in the wider, treeless areas, packed snow is nearly always available where needed from which thin blocks may easily be cut.

The same method can be used on the Arctic tundra for taking the two species of lemmings, *Dicrostonyx* and *Lemmus*. It was found that an especially fruitful place for the latter species is in the ruins of old Eskimo dwellings. The animals live in burrows, and crevices of the low and nearly overgrown stone walls and seem to be attracted to the greasy deposit of materials that thickly covers the floors of these ancient abodes. Traps persistently set in these and other places, which the lemmings are known to inhabit, will take specimens, but results are usually slow to materialize as the animals are not readily attracted to bait. However, they are known at times to gnaw on frozen meat in ground caches and, where such spots are regularly frequented, individuals may be taken by blind trapping. All ordinary lemming sets must be well housed by snow block con-

struction (similar to fig 1b) since wind and drifting snow is of frequent occurrence.

At times in calm, clear weather both species of lemmings—particularly *Dicrostonyx*—burrow to the surface and make trails in the snow. Traps set crosswise of these, at the entrances to the snow tunnels, may secure a few specimens, the same as with certain small mammals in timbered districts. Occasional strays of the collared lemming are found dead on lake and sea ice and provide good study skins. To be stressed is the necessity for marking all small traps conspicuously if natural landmarks are absent, otherwise they are easily lost on the open tundra; rarely loose stones are available in winter for building a small cairn, so the best all round locater is made from snow blocks set up in the vicinity of the traps.

While it is true that diurnal tree squirrels are most readily collected with a .410 shotgun, better skins and skulls are obtained by trapping. Two types of traps may be used, particularly for red squirrels—the No. 0 steel trap and the rat-sized model of the ordinary mouse trap. Good locations for the latter are on logs, stumps, midden heaps of shelled spruce cones and other likely places (fig. 1c and e). All such traps of this size should be anchored to a nearby stick, or limb, with a piece of light wire or cord about two feet long; this will prevent leg-caught animals from disappearing, together with the trap. Advantages arise from making sets, when possible, under wide-spreading conifers where considerable protection is gained from falling snow. Crushed cereals, fresh apple, or shredded dry fruit may be used for bait.

On the whole, superior results are obtained with the small 0 steel trap; this is of the same design as that employed by professional trappers of the larger furbearing animals. Blind sets are successful in squirrel runways and at well-used feeding stations, but the best method of winter-trapping these and many other species involves the use of the cubby set. This is made in the form of a small three-sided pen of short logs, or upright sticks driven into the snow close together and the whole covered with a thatch of bark or spruce boughs. For the smaller furbearers, size of the enclosure is a few inches wide and about a foot long. In actual practise the cubby is usually located in front of a big tree, thus saving the labor of building a rear wall (fig. 3). The lure—usually meat—is secured in the back of the cubby and the trap concealed just inside of the narrow front opening. In attempting to reach the bait the animal is forced over the trap at the only available point of entry. In all such sets the trap should be concealed and not left exposed as in the drawing.

Flying squirrels present difficulties, as they are usually hard to acquire. Because of their nocturnal habits they are seldom seen and rather rarely taken by ordinary methods of trapping. This seems to be the case especially in the warmer months. So far as personal experience is concerned, the animals are more often accidentally caught in winter at meat-baited cubby sets designed for weasel, marten, etc. (fig. 3). Cold weather induces them to visit such ground sets, which in summer and fall are almost invariably ignored. For this reason it is well for the mammalogist, in addition to his own efforts, to secure the cooperation of local

professional white or Indian trappers who may accidentally catch flying squirrels in traps set for the more valuable furbearers. Many specimens can thus be saved, which would otherwise only be thrown away, or merely used for bait. Occasional examples are easily trapped when they are found regularly visiting wilderness storehouses. At wide intervals, some are also captured when dry and partly hollow trees are felled for firewood.

A suggested method of taking flying squirrels is as follows: In a likely location lean a small log against a tree trunk with its upper end five or six feet from the ground. This end must be trimmed flat with the axe to provide a small platform on which to place the steel trap. It should be located with reference to

FIG. 3

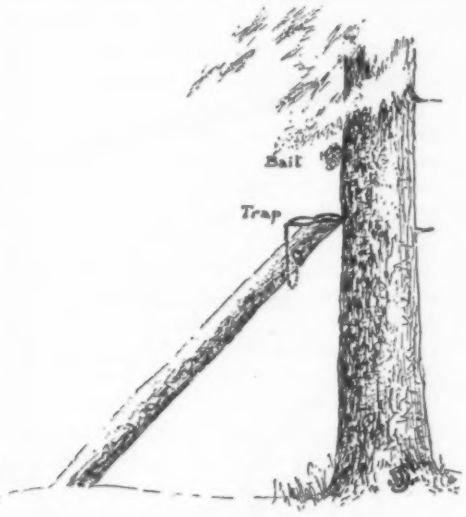

FIG. 4

FIG. 3. Baited cubby set employed for the capture of certain rodents and carnivores
FIG. 4. Leaning pole set for trapping marten, flying squirrels, etc. Trap should be concealed with moss, grass, or other vegetable matter

several small limbs projecting from the tree trunk a few inches above the trap. A canopy of evergreen boughs is constructed on these limbs and the bait secured immediately below. The roof of boughs serves the double purpose of preventing the animal from reaching the bait from above, as well as protecting the trap from snow (fig. 4). This method has also been used for the trapping of marten. A decided advantage of the set is that it excludes snowshoe hares and weasels, though it can still be put out of commission by red squirrels, Canada jays and other birds.

An adaptation of this set makes use of the wood-base rat trap on which the bait is secured directly to the trigger. The leaning pole is prepared the same as

with the preceding set; the baited trap is fastened to the diagonally cut upper end and then the pole hoisted into position against a tree at the proper angle. This method enables the collector to spot traps at a good height without leaving the ground—a distinct advantage that obviates the necessity of otherwise doing considerable climbing.

Another method employs the Schuyler, or common rat trap. These traps are attached to the trunks of fairly large trees well above the ground; if possible they should be located from at least ten to fifteen feet up (fig. 1g). This is for the reason that flying squirrels in successively gliding down from one tree to another usually land on the trunks high above ground-level and then ascend;

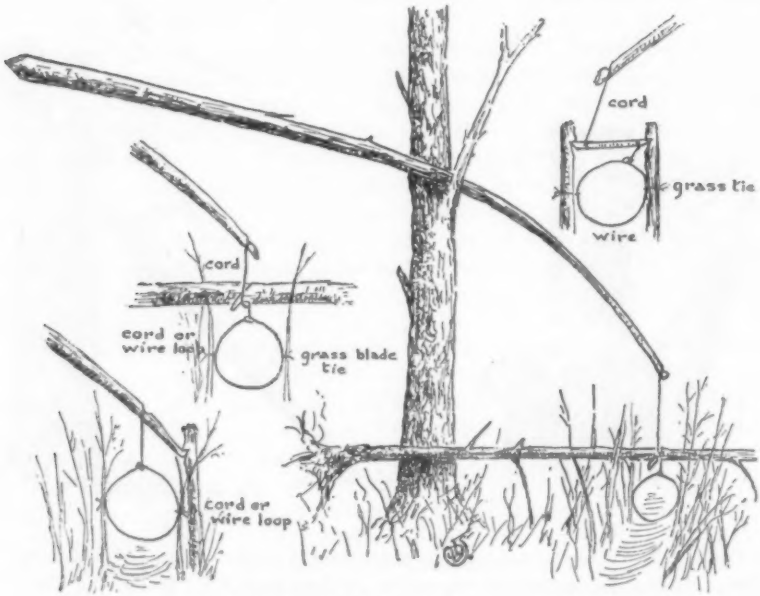

FIG. 5. Various methods of setting balance pole snares for hares and rabbits

therefore, lower sets might not be visited. As previously pointed out, however, there is a definite tendency on the part of these animals to descend to lower levels in winter; at least many are trapped in cubby sets at the base of trees. No particular bait of invariable effectiveness can be recommended. At various times and places they have been taken by the use of meat, oatmeal, sweet apples, prunes and bread. It may be necessary to carry out more or less prolonged experiments with different baits in any specified locality before attaining much success. The gun is of little avail in this field as flying squirrels are rarely seen and then usually in a bad light well after sundown.

The ground cubby set is widely used for catching weasels, other members of

the Mustelidae and a few additional species of carnivores. In trapping Arctic weasels a similar method is used, but in this case the cubby is constructed of snow blocks with the entrance facing away from the direction of prevailing winds (fig. 1b). At the same time a few individuals may be taken fortuitously in the more open sets made for the white fox, particularly where single-spring traps are used and lightly adjusted. In the South, the long-tailed weasel can also be captured at the cubby set; it is usually made only where the animals range into semi-wooded areas along the margins of the prairies. On the open plains, however, it is best taken in blind sets made at the mouths of burrows that it habitually visits. It may also be captured along its route of travel by employing a meat bait, which is pinned down well inside an old burrow, with the trap hidden a few inches in front. For these larger weasels the No. 0 steel trap may well be replaced by the somewhat larger No. 1 trap if more available. Even these may be so lightly adjusted that they will also take Bonaparte and least weasels in some localities if it is so desired.

In the north woods, mink regularly are caught along the banks of streams under the ice. Here an air space is created by subsidence of the water after the ice forms in early winter. Some type of three-sided pen is used, baited with meat or fish, with the trap secreted at the entrance. The animals may also be taken occasionally at meat-baited cubby sets in forest on the banks of streams and lakes. Mink have a curious habit of haunting beaver lodges and it is known that Indians often trap them in baited snow sets fashioned in the outer walls of these structures, as well as at beaver dams. There are many excellent methods of capturing mink in water sets that cannot be employed most of the winter. Where it is legal to do so, winter trapping of muskrats is most easily done inside their lodges; the hole cut in the wall, for the purpose of setting the trap on the bed inside, must be tightly closed again to prevent freezing of the diving hole. Fine, prime skins are to be secured, also, as soon as the ice goes out in the spring. In addition to trapping, excellent specimens may be taken with a .410 shotgun.

Snowshoe hares (and in some regions, cottontail rabbits) frequently blunder into cubby sets designed for other animals. In fact, the former species is a bane to the northern trapper because they so often foul traps and thereby prevent the capture of more valuable furbearers. Some individuals thus taken are acceptable to the mammalogist for specimens, but more often they are undesirable as the legs get broken and the skin in these parts becomes torn and bloody. Usually much better examples are taken by snaring. Snares are made of copper wire, or tough twine, which are placed in well trodden runways. These should be attached to a balance pole so that when the animal is caught the small end of the pole is released and the victim is lifted well off the ground (fig. 5). In this way its struggles are soon over and it is also beyond the reach of other animals that might otherwise mutilate the skin. In mild weather the spring pole method may be used, but in sub-zero temperatures the sapling thus pressed into service soon looses its spring and becomes incapable of lifting the catch off the ground.

National Parks Bureau, Winnipeg, Manitoba.

TEMPORARY PRESERVATION OF SMALL MAMMALS IN THE FIELD

By Ernest S. Booth

The collecting of mammals in the field is a task that entails much time and equipment if first class specimens are to be prepared. It is necessary to spend a great deal of time skinning and making up the skins. Then, too, adequate apparatus must be at hand to pin out the specimens to dry, to keep them from crowding and thus damaging each other, and to protect them from flies, beetles, and other pests. This apparatus for pinning the skins takes up much room, and is always bulky.

Sometimes the mammalogist may take a trip that is not primarily in the interest of mammals, and will not have time nor space to do any extensive collecting, yet even then he is always tempted to set a few traps no matter where he goes. But trapping is useless if lack of time does not permit the skinning of the catch. By using one or more of the methods outlined below it is possible to preserve the mammals caught on such trips in a temporary manner. Later, the next winter, perhaps, the mammals may be skinned and made up.

The following methods are not recommended, then, to take the place of the usual ones on a regular collecting trip, but become most useful when one does not have time enough to prepare skins, yet time enough to do at least some collecting. Then, an incidental advantage of these methods is the killing of any disease organisms, such as the causative agents of tularemia or bubonic plague, which are sometimes a real danger to the mammalogist as he skins the specimens he catches.

OTHER METHODS IN USE

A. B. Howell (1921, p. 117) wrote that "it is sometimes advisable while on a field trip to carry small mammals 'flat' instead of making up the skins on the spot." He then described the method he used. This was to skin the specimen as usual, wrap the leg bones, put a wire in the tail, cut a cardboard the size of the skin then stretch the skin over the cardboard. This method, while good in itself, takes almost as much time as making up the skin completely. Later the skin must be thoroughly relaxed before it can be made up properly. This takes a great deal of time in many instances.

A. H. Schultz (1924, p. 16) described methods for embalming mammals in the field. These are essentially the same methods as are commonly used in the laboratory for embalming cats, dogs, and monkeys, and have been adapted by Mr. Schultz for use in the field. Such methods would not be advisable for small mammals since the difficulty in embalming them would be too great. Modified embalming teachnique by injection of the embalming fluid into the body cavity with later immersion of the mammal in the fluid is essentially the process to be outlined in this paper. Mr. Schultz suggests this method in his article, but has in mind the use of the mammals for anatomical purposes rather than for the preparation of study skins.

G. G. Cantwell (1930, p. 324) recognized the value of a temporary method for

preserving small mammals in the field, and suggested the use of a salt-alum solution in which he immersed the skins after skinning. He says care must be used to see that no part of the skin touches another part of the skin, or the hair will slip. Skulls must not be left in this solution. Many mammalogists have experienced trouble whenever alum was used on skins, for it has a hardening effect that is difficult to overcome by relaxation.

J. L. Clark (1937, p. 89) writes of a method similar to that of Cantwell's, although after skinning he placed dry salt on all parts of the skin. It is necessary with this method to spend a good deal of time getting the salt into the skin, then to immerse the skin in a salt-alum solution until the skin reaches the laboratory. Here again the action of the alum is not always as mild as one might wish, and skins sometimes become so hard that relaxing is a real problem.

A. H. Howell (1937, p. 95) suggested a method more convenient than that by Clark or Cantwell. He advised placing powdered borax on all parts of the skin, in the pads of the feet, and in the tail. Then the skin is wrapped and taken back to the laboratory where it is relaxed and made up into a finished skin. This method has advantages over the others mentioned above, but still it is necessary to skin the specimens in the field then relax them in the laboratory. This requires more time than many people would have on a fast trip across the country.

E. R. Hall (1937, p. 359) raised some objections to the salt-alum methods in regard to the fading and other changes occurring or likely to occur in the skin or the fur. Similar objections may be raised to the methods outlined in this paper, but, according to observations of the many specimens the writer has prepared from temporary preservation, there has been no noticeable change in colors due to the action of the preservatives. This may be a real objection to the salt-alum solutions, but perhaps not to the formalin-phenol-glycerin method.

Charles Elton (1938, p. 244) mentioned the method of preparing skins in a "flat" condition with a piece of cardboard inserted permanently. While this is not suggested as a temporary method it would have some of the advantages of the temporary methods mentioned above; that is, it would be easier to store large numbers of skins on a collecting trip in a small place with no danger of damage from crowding. This method could hardly be called a time saver, however, for it would take nearly as long to prepare a flat skin by this method as one by the usual method. Then, too, since most museums have large collections of skins prepared as usual with artificial bodies, many mammalogists would hesitate to begin a new series by this process. Arthur and Ruth Svihla (1939, p. 111) report reasonable success with the method outlined by Elton, and perhaps others have also had success with it.

Schultz (*ibid.*) is the only one of these writers who has used any of the embalming methods. All the others have skinned their specimens before placing them in the preservative. Schultz, too, was interested only in the anatomical features of mammals, not in making up finished skins from the embalmed specimens.

The methods outlined below, then, may be considered as new ones for the temporary preservation of skins, but not for the anatomical structures of mammals. Incidentally, along with the preservation of the skin by the embalming

technique, the mammalogist will have a series of mammal bodies that may prove to be very useful to the anatomist. Many times we find that adequate anatomical knowledge regarding a certain mammal is lacking, while if embalming methods were used for the collecting of specimens not only the skin would be saved but also the body as well. Even the parasites—often so valuable to some mammalogists—would be well preserved by this process.

GENERAL METHOD OF EMBALMING

While the embalming fluid is the most important item under consideration in this paper, it will be well to outline briefly the process used in embalming the specimens.

The capture of animals may be done by the usual methods of trapping or shooting. When the specimen is ready to be embalmed the only equipment needed is a container about half full of embalming fluid, water-proof labels and ink, and an injection syringe with needle. No data need be written on the label except a key number. This label must be securely tied to the specimen. The rest of the data must be recorded in the field record. Injection of the animal is a simple matter. Small mammals the size of shrews and mice need be injected only in two or three places. The belly should be pierced with the needle and well filled with the embalming fluid. The thorax and the brain may also be injected, especially if the specimen is larger than a mouse. It is best not to inject the animal too full with the fluid or the shape of the finished skin will be distorted. Enough fluid must be injected to insure proper preservation, however, or the hair may slip when the skin is removed. It is best to make sure that each specimen is perfectly extended when it is finally immersed in the solution, for otherwise it may be difficult to make a symmetrical skin. Injection is not necessary if the belly is opened up and the internal organs removed. This allows the embalming fluid to penetrate to all parts of the body easily. Mammals larger than mice must have each leg injected. Squirrels, rabbits, and other larger mammals should be embalmed through the arteries by the method outlined by Schultz (1924, p. 16) then immersed in the embalming solution for permanent preservation.

A wide mouth gallon glass jar has been found the most satisfactory container for storage of specimens. Twenty or more mice and shrews may be placed in one jar with about two quarts of embalming fluid. The jars may be carried in cartons to avoid danger of breakage. Metal containers should not be used with embalming solutions containing formalin or phenol.

EMBALMING FLUIDS USED

A number of different solutions were used with varying degrees of success. Each one is here considered in detail.

Alcohol.—Straight 70% alcohol was used and found satisfactory for preservation if used in large quantity, but unless the volume of alcohol was many times larger than the volume of mammals the hair always slipped.

Straight 100% methyl alcohol was used and found satisfactory as a preserva-

tive even in small quantities, but the skin of the mammal was found to be very fragile, to tear easily, and to make up poorly.

Glacial acetic acid was added to both the above solutions, but to no noticeable advantage. The object, of course, was to get the alcohol to penetrate faster and more completely.

Glycerin was added to both alcoholic solutions to make the skins softer, but alcohol does not preserve the skins well enough to warrant its use at all.

Formaldehyde.—Straight 10% formaldehyde was found to be a good embalming solution, although the skins tended to become rather stiff and hard after a number of months or years. For short time preservation this solution is as good as any and less expensive to make. One specimen of a mole was skinned after five years of immersion in formaldehyde. It did not make a very smooth skin. A bat skinned reasonably well after two years preservation.

Ten percent formaldehyde with 5 percent glycerin (or 10 percent glycerin if preferred) was found to be a better solution than straight formaldehyde. The glycerin keeps the skin from hardening, and makes it flexible. This is one of the better solutions, and was found by Schultz (*ibid.*) to be good for larger mammals as well as the smaller ones. He also used it to preserve skins temporarily until they were made up.

Formaldehyde (five parts of 10%), alcohol (five parts of 95% or 100%), and one part of glacial acetic acid may be used, but it is not as good as that with phenol and formaldehyde. The skin tends to tear easily on skinning the specimen.

Salt-alum.—Solutions of salt and alum have been briefly discussed above, and can be used with some degree of success when the skins have been removed from the specimens. It is not advisable to inject the bodies with this solution, for skinning is made more difficult. It could be used as a substitute, however, if other chemicals were not available.

Phenol.—Phenol alone is not a good preservative, and must not be used in preserving mammals in either a 5% or a 10% solution.

A combination of phenol (10%), alcohol (100%), and glycerin was used with some success, but hair slips very easily in this solution unless the quantity of phenol is very low.

A mixture of phenol, formaldehyde, and glycerin with water has been found the best for embalming. Various formulae have been recommended for embalming, but ten parts of 100% formaldehyde, ten parts of pure melted phenol, ten parts of glycerin, and seventy parts of water has been found the best solution in actual practice. It is stronger than necessary if there is a large volume compared with the volume of mammals, but usually it is most convenient to have the container about half full then place the fifteen or twenty mammals (the size of mice) in the solution. It is then strong enough to preserve all these mammals without adding further preservative. About 5% glacial acetic acid added to this will aid in penetration of the solution, but if injection is completely done this is not needed. Injection should be complete in any case.

More than twenty-five specimens collected by the writer on a recent trip across

the United States have been preserved in the formaldehyde-phenol-glycerin embalming fluid and made up in the usual manner with artificial cotton bodies. These skins were easy to handle, and made up into perfect specimens in all cases. In a few cases they were even superior to those made up from fresh skins. The head, and especially the nose and mouth, maintained the original animal shape rather than the usual rounded shape that comes from the use of cotton for an artificial body in a fresh skin. It is not necessary to sew up the lips since the mouth is a bit stiff and remains in perfect position. There is not the usual flexibility in the skin, of course, so if the animal happens to be out of shape it is hard to make the skin assume a good shape. If one is careful with the injection there will be no trouble with this, however.

Mammals may be left in the embalming fluid for several years if necessary, and may still be skinned out perfectly, but skinning is easier if done sooner. No attempts have been made to determine the effects of this embalming fluid on coloration, but the specimens I have show no change of color at present.

SUMMARY

Several solutions for embalming mammals in the field have been tried and the results indicated. The best was found to be a mixture of formaldehyde, phenol, glycerin, and water. It was found to keep the skin soft and pliable so that skinning and making up of the skin could be done at a later time. This saves much time in the field, but does not take the place of the usual process of skinning and making up a fresh skin whenever time permits.

LITERATURE CITED

CANTWELL, G. G. 1930. Preparing mammal skins in the field. Jour. Mamm., vol. 11, pp. 324–325.

CLARK, J. L. 1937. Preservation of mammal skins in the field. Jour. Mamm., vol. 18, pp. 89–92.

ELTON, CHARLES. 1938. A convenient method of mounting and storing the skins of small mammals. Jour. Mamm., vol. 19, pp. 244–245.

HALL, E. RAYMOND. 1937. Deleterious effects of preservatives on study specimens of mammals. Jour. Mamm., vol. 18, pp. 359–360.

HOWELL, A. B. 1921. Field suggestions. Jour. Mamm., vol. 2, p. 117.

——— 1937. A simple method of saving small mammals in the field. Jour. Mamm., vol. 18, p. 95.

SCHULTZ, A. H. 1924. Preparation and preservation of anatomical and embryological material in the field. Jour. Mamm., vol. 5, pp. 16–24.

SVIHLA, ARTHUR AND RUTH DOWELL. 1939. Elton's method of preparing mammal skins. Jour. Mamm., vol. 20, p. 111.

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THE SHORT-TAILED SHREW AND FIELD MOUSE PREDATION

By W. Robert Eadie

The ecological relationship between short-tailed shrews (*Blarina brevicauda*) and mice (chiefly *Microtus pennsylvanicus*) has long been a matter of conjecture and study. As early as 1842, Plummer (1844) fed live mice to a captive shrew and described the destruction of the mouse by the shrew. Morden (1883), Merriam (1886), Shull (1907), Babcock (1914), and Hamilton (1930) have published reports of a repetition of this early experiment. Merriam (*op. cit.*) concluded from such evidence that "the Short-tailed Shrew preys largely upon mice, and is, consequently, of great economic value to the farmer . . ." Shull (*op. cit.*), using similar evidence plus the significant fact of finding a *Blarina* nest composed exclusively of the hair of voles with three carcasses and the legs and tails of twenty others nearby, came to the conclusion that this shrew preys heavily on mice. Hahn (1908) and Bailey (1923) present evidence of the actual pursuit and capture of voles by *Blarina* under natural conditions.

Hamilton (1930 and 1941) made detailed studies of the food of the short-tailed shrew by analyzing the contents of a total of 460 stomachs. He found mouse remains in only 14 stomachs (3 percent) and concluded from this direct evidence that "the short-tailed shrew has been credited with greater mouse destruction than it is capable of committing."

The recent discovery by Pearson (1942) of a poisonous material in the saliva from the submaxillary glands of *Blarina* suggests that this shrew may have greater potentialities as a mouse destroyer than has been recognized in recent years. Further evidence was sought on this shrew-mouse relationship during the late winter and early spring of 1943 at Ithaca, New York. This resulted in the discovery of several winter nests, their associated burrows, over 200 well preserved scats along with other less well preserved droppings, and various mouse remains in the vicinity of the nests.

EVIDENCE FROM NESTS AND BURROWS

All the nests and burrows discovered were located either in large abandoned fields or in the hedgerows bordering them. These fields were covered with various grasses, weeds and occasional clumps of briars (*Rubus* sp.). The soil was a stony, silty clay loam.

One winter nest was so unusual in its location as to deserve a detailed description. All nests of the short-tailed shrew on record have been underground or at least under some surface structure such as a stone, log or stump. In this instance, the nest was revealed by the melting snow of late winter at the southern edge of a hedgerow. It was located on the ground surface in a shallow depression at the base of a small sapling and was composed entirely of the unshredded leaves of red maple, choke cherry, white oak, and hickory, all readily available in the vicinity. The nest was a flattened sphere measuring 14 cm in greatest diameter while the central cavity had a diameter of about 6 cm and was lined only with flattened leaves. Several surface runways led to the nest, but the nearest burrow opening

was two and one-half feet away with another five feet distant. The remains of at least four field mice (*Microtus pennsylvanicus*) were scattered about in the surface runways at distances of from one-half to three feet from the nest. These consisted of feet, leg bones, fur and in one case, the forepart of the cranium. Three midden heaps composed of the characteristic scats of *Blarina* were found beside surface runways near the nest at distances of two, twelve, and fourteen inches. These well preserved scats, when moistened, had the distinctive odor of this shrew and were saved for analysis. Several *Blarina* droppings were found among the leaves forming the floor of the nest.

A second winter nest of this shrew was found in the center of a large field where an excrement heap was located at the mouth of a burrow. Excavation disclosed that the burrow led to a rounded chamber, 10 cm in diameter, containing a nest of coarse grass six inches below the surface of the ground. Directly to one side was a second chamber filled with a mass of grassy debris and loose soil that contained the fur and hide of a field mouse. The scats at the entrance to the burrow were badly weathered by several weeks of intermittent heavy rains and only those scats containing mouse fur retained their characteristic shape, but all were collected for laboratory analysis.

A third location in the same field consisted of a similar short burrow leading to a circular nest chamber that contained no nesting material. This burrow was identified as before by the midden heap at the opening. These scats were even more badly weathered than the last but the material was collected.

The fourth location was under a rotten board in a hedgerow. A dry, well-worn burrow ran the length of the board, at one end branching off into surface runways through the grass, and at the other, leading to the interstices of a small, half-buried rock pile. At one side of the midlength of the burrow was a small chamber containing a nest of grasses. This nest had the characteristic construction features of a *Microtus* nest although a shrew may have been using it. Scattered along the otherwise clean floor of the burrow were the elytra and appendages of several May beetles (*Phyllophaga*) and two *Blarina* scats. The well-cleaned anterior portion of the cranium of a field mouse was found tucked away at one side of the burrow.

EVIDENCE FROM SCAT ANALYSES

The well-preserved scats from the first nest described were analyzed individually under the microscope and the various remains of food items recorded by frequency of occurrence in the total number of scats examined. Difficulties were anticipated in this procedure because of the finely comminuted nature of the remains but, for the most part, these were not insurmountable. The scats contained a variable proportion of detritus and unidentifiable material, but the food remains in the greater portion of each scat could be readily classified as to type. The procedure followed was to place each scat in a petri dish under a dissecting microscope, moisten it with a little water and tease it apart with needles. These were regarded as winter scats and the results of the analyses of 200 of them are presented in Table 1.

Although this paper is chiefly concerned with the shrew-mouse relationship, a few notes are recorded concerning the other winter food of *Blarina* as revealed by these analyses.

Insects.—The occurrence of insects in 95.5 percent of the scats indicates that *Blarina* is never at loss to find this type of food during the winter months although frequently the insect remains constituted only a small portion of an individual dropping. Of the larvae and pupae, wire worms (Elateridae) were easily recognizable in 49 percent of the scats. This item may have considerable economic significance. Ants usually occurred in large numbers when present in a scat, as would be expected if dormant colonies were encountered by the shrew.

Annelids.—The setae of earthworms made up this item. Their high frequency (40 percent) in the winter diet indicates that *Blarina* often feeds below the frost line.

TABLE 1.—*Winter food of the short-tailed shrew based on 200 scat analyses*

FOOD	FREQUENCY PERCENTAGE
Insects (all types)	95.5
Larvae and pupae	87.0
Coleoptera	64.5
Hymenoptera (ants)	23.5
Hemiptera	16.5
Other insects	2.5
Mammals (all types)	60.5
Mice	56.0
Shrews	2.0
Unidentified small mammals	2.5
Annelids	40.0
Millipedes and centipedes	30.0
Crustaceans	23.0
Plant materials	8.0
Molluscs	1.0

Millipedes, Centipedes, Crustaceans and Molluscs.—Millipedes and centipedes formed a substantial part of the winter diet (30 percent), of which the majority were millipedes. These latter were very abundant in the area. The crustaceans were isopods (23 percent), also abundant in the habitat. The considerable percentage of these items in the winter diet of *Blarina* is in contrast to Hamilton's (1930) analysis of the stomach contents of 66 *Blarina* taken in winter, where neither millipedes, centipedes nor crustaceans were found. Molluscs had a frequency of only 1 percent in the scats and consisted of one entire tiny snail shell and the remains of a slug. It is possible that more of this type of food was eaten than is indicated since these soft bodied forms would ordinarily leave little trace in the droppings.

Plant materials.—Rootlets and grass fragments often appeared in the scats but were not recorded since they never appeared in quantities sufficient to indicate that they were taken intentionally as food. Eight percent of the droppings con-

tained broken seed coverings indicating the ingestion of seeds as food. It is possible that plant food may have been taken more frequently than indicated here since starchy plant food (as reported in stomachs by Hamilton, 1930) would presumably leave no recognizable trace in the fecal matter.

The fragment of a bird feather appeared in one dropping and probably represented carrion.

Mammals.—An amazing percentage of the scats contained the remains of mammals (60.5 percent). These consisted most often of masses of fur, but bone fragments, claws and even entire foot bones often appeared. Fragments of long bones, crania, ribs, vertebrae, carpals or tarsals, and metacarpals or metatarsals were identified. Frequently the scats were composed almost entirely of masses of fur with bone fragments and a few miscellaneous items, such as insect remains, scattered throughout. Such scats under the microscope looked like miniature fox droppings. Mouse remains had a frequency percentage of 56; shrews, 2; unidentified small mammals, 2.5. Mammal hairs were identified by direct comparisons under the microscope. Criteria established by Mathiak (1938) and Williams (1938) were also used in the hair identification.

The mouse remains appeared to be principally those of *Microtus pennsylvanicus*. No attempt was made to identify shrews as to species and this item was recorded only when sufficient remains indicated that it had constituted a meal. Scattered shrew hairs occasionally occurred in droppings but were regarded as probably originating from the shrew itself. In several droppings, small mammal bone fragments appeared in such a condition that they could not be identified further.

To corroborate the above findings, fecal material was examined from the other *Blarina* locations described. The weathered character of most of this material made it impossible to analyze individual scats. However, approximately 25 percent by bulk of the collection from the second nest location consisted of scats that had retained their form and were composed chiefly of mouse fur and bones. Examination of the remainder of this collection revealed mouse hair and bone fragments scattered throughout the mass of insect, millipede, and sowbug remains. Wire worms were again abundantly present. It is concluded that in this instance also mice occupied a prominent place in the shrew's diet and, although no definite figure can be assigned to it, the frequency percentage here would be at least 25 and possibly nearer 50.

The greatly weathered fecal material from the third location revealed only scattered mouse hairs throughout a mixture of insect, millipede, earthworm, sowbug and other remains. There is some question as to the date of deposition of this material and it may have dated from the previous fall.

An examination of the two scats from the fourth location revealed that one contained chiefly coleopterous remains with a few wire worms and shrew hairs, while the other was composed almost entirely of *Microtus* fur with a few insect fragments and one pupal case of an ant.

DISCUSSION

It is apparent from these data that in certain habitats in the winter of 1942–43, field mice formed a large part of the diet of *Blarina*. The possibility must be

considered that some of the field mouse material in the diet represented carrion, although no trapping operations that would make such available were conducted on the areas in question.

A conservative estimate of the *Microtus* population in comparable areas in the fall of 1942, based on trap-removal quadrat censuses, was 80 mice per acre, while the spring population in these habitats had dropped to a low of 12 mice per acre. These figures indicate the end of a period of increase in the local microtine cycle in the winter of 1942–43. Thus the high percentage of field mice in the shrew diet coincided, in part, with a period when the mice were presumably experiencing a high degree of mortality generally. Hamilton (1937) suggests that disease may play an important part in this mortality. It is possible, then, that the shrews may have been feeding on mice weakened or dead from disease. On the other hand, when the mouse population was high, simple availability may have led the shrews to prey heavily upon them.

Using the data from the first described *Blarina* nest one may obtain a concept of the number of mice consumed in the course of the winter. Hamilton (1929) believes that these shrews remain paired throughout the year except when there are young. Assuming, therefore, that two shrews were using this nest location (it may have been only one), the remains of at least four mice near the nest as well as at least five mice in the scats may be tallied against them. This latter figure is ultraconservative as it is based on the occurrence of 18 mouse feet in the droppings and takes no account of the other 94 scats that contained mouse remains. It is certain that the shrews do not always completely consume the mice. Thus, a total of at least nine mice were accounted for by one, or possibly two, shrews. The fall population of *Blarina* on this type of habitat was conservatively estimated at three per acre on the basis of trap-removal quadrat studies. Short-tailed shrews might thus have accounted for at least 14–27 mice per acre during the winter months. Circumstantial evidence points to a higher figure. If this represents actual predation, it is of considerable significance in the local microtine cycle.

Additional data from other stages in the mouse population cycle are needed to clarify this shrew-mouse relationship, and observers should be alert to collect *Blarina* droppings wherever found in quantity since such finds are, for the most part, fortuitous.

LITERATURE CITED

Babcock, H. L. 1914. The food habits of the short-tailed shrew. Science, n.s., vol. 40, no. 1032, pp. 526–530.

Bailey, Vernon. 1923. Mammals of the District of Columbia. Proc. Biol. Soc. Washington, vol. 36, pp. 103–138.

Hahn, Walter L. 1909. Mammals of Indiana. 33d Annual Rep. Dept. Geol. and Natural Resources of Indiana.

Hamilton, W. J., Jr. 1929. Breeding habits of the short-tailed shrew, *Blarina brevicauda*. Jour. Mamm., vol. 10, no. 2, pp. 125–134.

——— 1930. The food of the Soricidae. Jour. Mamm., vol. 11, no. 1, pp. 26–39.

——— 1937. The biology of microtine cycles. Jour. Agric. Research, vol. 54, no. 10, pp. 779–790.

——— 1941. The food of small forest mammals in eastern United States. Jour. Mamm., vol. 22, no. 3, pp. 250–263.

MATHIAK, HAROLD A. 1938. A key to hairs of the mammals of southern Michigan. Jour. Wildlife Management, vol. 2, no. 4, pp. 239–250.

MERRIAM, C. H. 1886. The mammals of the Adirondack region. pp. 166–169. Henry Holt and Co., New York.

MORDEN, J. 1883. Canadian Sportsman and Naturalist, vol. 3, p. 283.

PEARSON, OLIVER P. 1942. On the cause and nature of a poisonous action produced by the bite of a shrew (*Blarina brevicauda*). Jour. Mamm., vol. 23, no. 2, pp. 159–166.

PLUMMER, JOHN T. 1844. Scraps in natural history (Quadrupeds). Amer. Journ. Sci. Arts, vol. 46, pp. 236–249.

SHULL, A. FRANKLIN. 1907. Habits of the short-tailed shrew *Blarina brevicauda* (Say). Amer. Nat., vol. 41, pp. 495–522.

WILLIAMS, CECIL L. 1938. Aids to the identification of mole and shrew hairs with general comments on hair structure and hair determination. Jour. Wildlife Management, vol. 2, no. 4, pp. 239–250.

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HISTORY AND PRESENT STATUS OF BIGHORN IN SOUTH-CENTRAL NEW MEXICO

BY ARTHUR F. HALLORAN

The Mexican bighorn (*Ovis canadensis mexicana*) (Cowan, 1940, p. 545) is the endemic form of mountain sheep in southern New Mexico. At the present time but three herds are known in the state. These are found in the Guadalupe, San Andres, and Big Hatchet mountains. The only other bighorns in New Mexico are several from Canada planted by the state game department in the Sandia Mountains near Albuquerque. This paper pertains chiefly to the herd in the San Andres Mountains but includes records of sheep from the Organ Mountains immediately to the south.

LOCATION

Darton (1928, p. 183) describes the San Andres Range as follows: "The San Andres Mountains are one of the most prominent ranges in New Mexico. They begin at San Augustine Pass, northeast of Las Cruces, and extend north to Mockingbird Gap, a distance of 75 miles. The altitude of the adjoining plains is 4,000 feet, and most of the higher peaks of the range rise somewhat more than 7,000 feet; Salinis Peak, the highest summit, is 9,040 feet above sea level according to the Wheeler Survey. The range presents to the west a long slope of limestone and to the east a precipitous slope consisting of granite and schist surmounted by cliffs of limestone. The range is structually a westward-dipping monocline. . . ." The range is flanked on its western side by the Jornada del Muerto, a dry plain separating the mountains from the Rio Grande. The eastern declivity of this long, narrow range faces the Tularosa Basin, which contains the White Sands area of New Mexico. To the south of San Augustine Pass the continuing mountains are known as the Organ Mountains. Bailey (1913, frontispiece) in his map of the life zones of New Mexico shows that these mountains are largely in the Upper Sonoran Zone with small areas of Transition Zone in the Organ Mountains and

the northern San Andres. At present, the sheep are found in the rough rims and adjacent areas of the Upper Sonoran Zone dominated according to site by various plants of the semi-desert type, including *Cercocarpus*, *Agave*, *Dasylirion*, *Nolina*, *Opuntia*, *Garrya*, *Fendlera*, *Fallugia*, and *Condalia*, as well as various weeds and grasses, of which the gramas (*Bouteloua*) are prominent.

EARLY RECORDS

Cave deposits (Ayer, 1936) and ethnobiological evidence (Castetter and Opler, 1936) indicate that bighorn sheep have been in this region from before the time of written history. The San Andres Mountains were a favorite haunt of the raiding Mescalero Apache Indians who were known to use artifacts of the horns and to eat the flesh of mountain sheep (*ibid.* pp. 5, 19, 25). Mescal pits can still be seen in the southern San Andres and arrowheads, pottery, and other artifacts are found around old Indian campsites. Unfortunately, little is known of bighorn numbers in the days of Indian occupation, but the presence of the sheep today in rough areas largely ungrazed by domestic stock suggests that when more such areas were available more sheep were present.

Lt. W. H. C. Whiting (1850, p. 201) writing of his explorations mentioned the Organ Mountains and the bighorn as follows: "It appears there are three distinct ranges of mountains traversing the country east of El Paso in a north and south direction: the first the Organ range, twenty miles east of the Rio Grande;. . . ."

"These wild and rocky mountain ranges are the places where several animals resort that are to be met with nowhere else. . . . The bighorn, or cimarron, is also seen skipping playfully from rock to rock upon the narrow overhanging crags, and cropping the short herbage which grows upon them. . . ."

Townsend (1893) mentions mountain sheep in the Organ Mountains and adds that Mr. G. R. Beasley of Soledad "is reported to have killed a full-grown mountain sheep two years ago in the Organs." Mr. A. D. Litton of Hatch, New Mexico lived in the southern San Andres Mountains in the middle nineties. While looking for a stock-killing bear in May 1895, he saw six or seven sheep on the crest of the range east of the saddle between Ropes Canyon and Ash Spring. He also spoke of a large ram killed by a miner, Mr. Green Crawford, who packed the sheep to his camp in San Andracito Canyon by burro where the skull with horns could be seen for many years. C. M. Barber, who collected in the San Andres region in the 1890's (F. M. Bailey, 1928, p. 28) (Poole & Schantz, 1942, p. 51) mentions sheep in the Guadalupes (1902, p. 191) but not in the San Andres or Organ mountains. This leads us to infer that although the sheep were doubtless present they were both scarce and little known at the time.

Bailey (1931, p. 18) cites Gaut who reported in 1903 "a small bunch living in the mountains between Bear Canyon and San Augustine Peak" in the southern part of the San Andres Range. Gaut also reported at this time that the sheep found formerly in the crest of the Organs had not been seen recently. Ligon (*ibid*, p. 18) learned from an old trapper in 1915 that 30 or more were still to be found in the San Andres. Scattered reports indicate that bighorn were occasionally seen in the San Andres during the 1920's. By 1936, after the drought

years of 1933 and 1934, these animals were estimated by the Forest Service (1936) to number but 20 to 30.

Hornaday (1901) notes that a reliable observer, Mr. C. J. Jones, saw a bighorn in the Organ Mountains southeast of Las Cruces in 1901. Ranchers living in the Organ Mountains report mountain sheep as being present in small numbers up to about 1937. Their number were doubtless very small, however, and little was known of them as Ligon (1927) does not mention the remnants of the Organ Range in his study of existing New Mexican bighorn herds. In 1941 we received reports of a single large ram having been seen at the north end of the Organ Mountains near San Augustine Pass. It is possible that sheep occasionally wander between the southern San Andres and northern Organ mountains.

PRESENT STATUS

After having been a state game refuge for several years, the most favorable bighorn range of the southern San Andres Mountains was set aside in 1941 as the San Andres National Wildlife Refuge of the Fish and Wildlife Service, U. S. Department of the Interior. The majority of the remaining sheep are doubtless in this new refuge although persistent reports indicate that a few bighorns can still be found in the more northerly parts of the range, as well as to the south in the Organ Mountains.

Under protection on the refuge the bighorns are slowly increasing. Ten lambs were reported in 1942 and the 1943 crop of lambs also numbered at least 10. The total present (1943) bighorn population is more than 60. This estimate is based on a field survey of animals seen, and on sign and tracks. Some water supplies have been developed and present plans call for more of this important work. Preliminary food studies based on browse utilization and field observations indicate competition between the sheep and the numerous mule deer. A successful public hunt for bucks and does was held in 1942 with the cooperation of the New Mexico State Game and Fish Commission to reduce deer numbers and plans are being laid to continue this herd regulation. Thus a start has been made in the management of the small band of Mexican bighorns on one of their ancestral ranges.

LITERATURE CITED

Ayer, Mary Y. 1936. The archaeological and faunal material from Williams Cave, Guadalupe Mountains, Texas. Proc. Acad. Nat. Sci. Pheladelphia, vol. 88, pp. 599–619.

Barber, C. M. 1902. Notes on little-known New Mexican mammals and species apppparently not recorded from the territory. Proc. Biol. Soc. Washington, vol. 15, pp. 191–193.

Bailey, F. M. 1928. Birds of New Mexico. New Mexico Dept. of Game and Fish.

Bailey, Vernon. 1913. Life zones and crop zones of New Mexico. North American Fauna, no. 35.

——— 1931. Mammals of New Mexico. North American Fauna, no. 53.

Castetter, E. F. and M. E. Opler. 1936. The ethnobiology of the Chiricahua and Mescalero Apache. Univ. of New Mexico Bul. 297.

Cowan, Ian McTaggert. 1940. Distribution and variation in the native sheep of North America. The American Midland Nat., vol. 24, no. 3, pp. 505–580.

DARTON, N. H. 1928. "Red beds" and associated formations in New Mexico. U.S.G.S. Bul. 794.

HORNADAY, W. T. 1901. Notes on the mountain sheep of North America with a description of a new species. New York Zool. Soc., 5th Ann. Report., pp. 77–122.

LIGON, J. STOKLEY. 1927. Wild life of New Mexico: its conservation and management. New Mexico State Game Comm., Santa Fe. 212 pp.

POOLE, A. J. and V. S. SCHANTZ. 1942. Catalog of the type specimens of mammals in the United States National Museum, including the Biological Surveys collection. United States Nat. Mus. Bul. 178.

TOWNSEND, C. H. T. 1893. On the life zones of the Organ Mountains and adjacent region in southern New Mexico with notes on the fauna of the range. Science, 22, pp. 313–315.

U. S. FOREST SERVICE. 1936. Fish and game report of the Jornada Experimental Range. Typed report in the files at the headquarters of the Jornada Exp. Range.

WHITING, LT. W. H. C. 1850. Reports of the secretary of war, 31st. congress, 1st session. ex. doc. no. 64, July 24, 1850. The report of Lt. W. H. C. Whiting's reconnaissance of the western frontier of Texas.

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THE CAPTURE OF THE BRAZILIAN MOUSE BLARINOMYS BREVICEPS

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Blarinomys breviceps (Winge), a cricetine South American rodent, was described by Winge (1888) from a muzzle found by Lund in a comparatively recent fossil deposit at Lagoa Santa, Minas Gerais. Several years later Goeldi found an individual dead in a drainage pipe at Fazenda Colona Alpina, Teresópolis, thereby establishing the species as Recent. Thomas (1896) and Goeldi (1902) described the specimen and the circumstances of collection. Since no other specimens are known to exist, the capture of an adult male merits description.

The observations here reported were made in the course of studies under the auspices of the Serviço de Estudos e Pesquizas sôbre a Febre Amarela, which is maintained jointly by the Ministry of Education and Health of Brazil and the International Health Division of The Rockefeller Foundation.

Circumstances of Capture.—Since May, 1942, studies of the ecology of possible hosts and vectors of yellow fever have been conducted at Fazenda Boa Fé, a farm about 20 kilometers northeast of Teresópolis, State of Rio de Janeiro, Brazil. The farm is located about ten kilometers from Fazenda Colona Alpina, where Goeldi found his specimen of *Blarinomys*. The locality is part of the extensively cultivated uplands (altitude 840 meters). The valleys of the region are cultivated but the hills are more or less covered by second-growth forest.

During a special capture of mosquitoes conducted at 3:30 p.m. on January 13, 1943, a sunny day with temperature at 22°C (71°F), one of the guards, Carlos Ciardelli, of a field unit of the Serviço de Estudos e Pesquizas sobre a Febre Amarela, caught an individual of *Blarinomys*. The animal had run across an open path and when captured was disappearing among the dead leaves and twigs on the ground. The individual had come from a thicket of small bamboo (taquara)

where there were numerous mouse tunnels among the roots and leaves. The individual died in a half hour as a result of injuries received when captured.

The forest is an area of second growth (capueirão) about 70 years of age. It is on a hill several hundred meters from water. Some of the trees are about 20 meters high and the undergrowth is thick. The forest floor is covered with dead leaves and twigs but there is only a small amount of humus. In places, roots provide favorable situations for tunnels.

Trapping has been carried out with conventional snap traps and tin-can live traps for one week during each month since August, 1942. The mice *Akodon*

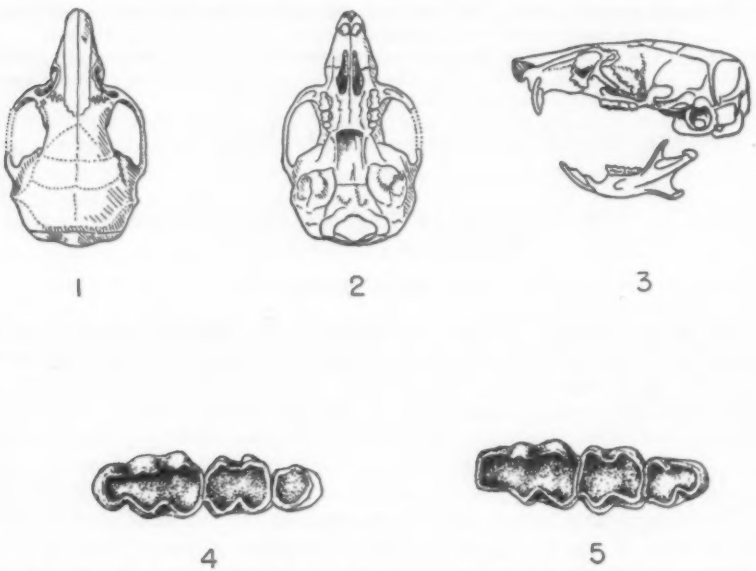

FIG. 1. Drawings of skull of *Blarinomys breviceps*. (1) Dorsal view; (2) ventral view; (3) lateral view; (4) upper cheek teeth series; (5) lower cheek teeth series.

Specimen M 15130, Serviço de Estudos e Pesquizas Sobre a Febre Amarela, Rio de Janeiro, Brazil. Drawings by Dr. João Moojen, Museu Nacional.

arviculoides, *A. nigrita*, and *Delomys dorsalis* are common and easily caught. Several individuals of *Didelphis marsupialis* are present and a few of *Caluromys philander* inhabit the trees. An occasional individual of *Procyon cancrivorus* and of *Philander opossum* probably passes through the area.

Comments.—The capture of this specimen suggests that if the area were intensively trapped with a type of trap adapted for subterranean runways other specimens would soon be obtained. It should be noted that small mammals have not been intensively trapped in Brazil, and that few special traps have been used. Furthermore, the forest type in which this individual was caught covers a great area.

The capture of this individual on a bright afternoon suggests that the species is active during the daytime. Possibly by some fortuitous circumstance, the animal left his runway and wandered blindly in the bright sunlight. The eyes are so small that it is difficult to believe that the animal can distinguish much more than moving objects and light from dark. The structure of the animal obviously indicates subterranean habits.

Description.—Since the description by Thomas (1896) was based on an alcoholic specimen, the following description, written with the help of Remington Kellogg, is appended.

Diagnosis.—Form soricine, modified for burrowing; head short and conical; eyes minute, hidden in fur; claws relatively long; distinct claw on pollex; tail short; fur crisp, velvety, and iridescent; hind foot, 15–18 mm; braincase of skull flattened; rostrum robust; condylobasal length, 23 mm; greatest length, 25.5 mm.

External characters.—Ear quite small (from notch, 9 mm), hidden in the fur; palmar tubercles, 5; plantar tubercles, 6; underside of heel hairy; tail distinctly annulated, the annulations partially hidden by stiff hairs.

Color.—Near dusky purplish-gray; hairs of back with darker tips; tip of muzzle faintly whitish; chin and eyelids without brown hairs; hands and feet fuscous (Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912).

Skull.—Braincase distinctly flattened; zygomatic breadth exceeds breadth of braincase above external auditory meatus; interparietal entirely absent; rostrum relatively shorter than in *Oxymycterus* and robust; bullae inflated; palate relatively wide (3.6 mm) and short; palatine foramina prolonged backward beyond level of anterior end of cheek-tooth row; interpterygoid fossa relatively wide; cheek teeth worn to such an extent that cusps have been obliterated.

Measurements (in millimeters) of adult male.—Total length, 148; tail, 48; hind foot, 18; ear from notch, 9. Skull: condylobasal length, 23; zygomatic breadth, 14; interorbital constriction, 6.4; breadth of braincase posteriorly, 12.6; depth of braincase posteriorly, 9.2; length of nasal, 11.2; diastema, 6; length of mandible, condyle to anterior end, 14.4; length of maxillary tooth row, 4.1; length of mandibular tooth row, 3.5.

LITERATURE CITED

GOELDI, EMILIO A. 1902. Dois Roedores notaveis da familia dos Ratos do Brasil. Bol. Mus. Paraense Hist. Nat. e Ethnographia (Museu Goeldi), Belem, vol. 3, fasc. 2, pp. 166–180, pls. 1–2.

THOMAS, O. 1896. On new small mammals from the Neotropical region. Ann. and Mag. Nat. Hist., ser. 6, vol. 18, no. 106, pp. 301–314.

WINGE, HERLUF. 1888. Jordfundne og nulevende Gnavere (Rodentia) fra Lagoa Santa, Minas Gerais, Brasilien. E Museo Lundii, Kjøbenhavn, vol. 1, pp. 1–200, pls. 1–8.

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NOTES ON MEXICAN MAMMALS

By William B. Davis

Information obtained in the years 1941–42 by field parties from the Department of Fish and Game, Agricultural and Mechanical College of Texas, is presented here to augment the published records of Mexican mammals. Recent literature on the subject is scattered and largely of a systematic nature; little has appeared in print on such subjects as habitats, abundance, and breeding habits. Because we have some information on these topics, it seems timely to make it available to others interested in the mammalian fauna of México.

Taxonomic and systematic problems also are included. Three forms (*Glossophaga soricina alticola*, *Nycticeius humeralis mexicanus*, and *Reithrodontomys fulvescens tropicalis*) are described as new; *Cratogeomys irolonis* is treated as a distinct species; *Reithrodontomys perotensis*, *Neotomodon perotensis* and *Dipodomys perotensis* are reduced to subspecific status; *Neotomodon orizabae*, *Reithrodontomys chrysopsis orizabae*, *Reithrodontomys megalotis cinereus*, *Cratogeomys oreocetes*, and *Cratogeomys merriami peregrinus*, are considered invalid and placed in synonomy. Several extensions of range are noted.

This report is based upon notes derived from more than 2,500 man-days of field work in the Mexican states of Nuevo Leon, Tamaulipas, San Luis Potosí, Hidalgo, México, Tlaxcala, Puebla, Veracruz, Morelos, and Guerrero, and upon an examination of more than 1,000 specimens.

For assistance in determining difficult specimens I wish to thank Dr. E. Raymond Hall, Museum of Vertebrate Zoology, Berkeley, California; Dr. David H. Johnson, U. S. National Museum, and, especially, Edward A. Goldman, U. S. Fish and Wildlife Service. Also, I appreciate the helpfulness of Dr. H. H. T. Jackson, U. S. Fish and Wildlife Service, in making available to me specimens needed for comparative purposes. Dr. Seth B. Benson, Museum of Vertebrate Zoology, Berkeley, California, Dr. E. Raymond Hall, and E. A. Goldman have made valuable suggestions and have critically examined the manuscript. For the wholehearted cooperation of the officials of the Dirección General Forestal y de Caza I am deeply appreciative. The Texas Cooperative Wildlife Research Unit, College Station, contributed importantly in supplying services and matériel necessary to carry out these investigations.

ITINERARY

The 1941 party, largely one of reconnaissance and comprised of 10 students from the Agricultural and Mechanical College of Texas and the writer, as leader, entered México June 18 at Nuevo Laredo and returned July 16.

The work in 1942 was more auspicious; the personnel numbered thirty-two, and the field was expanded to include fisheries investigations, under the supervision of Cecil W. Reid, and plant surveys, conducted by Nevin Weaver. The writer was in general charge of all operations. During the period June 1–July 12, the party worked as a unit; from July 12 to August 20, base camp was established in the mountains east of Mexico City and subcamps, comprised of

four men each, were established at selected localities from sea level to timber line. As these camps were moved every 7 to 10 days, we were able to sample a variety of plant-animal communities in the tropics, the deserts, and the high mountains.

COLLECTING STATIONS

Nuevo Leon

1[1]. 50 miles south of Nuevo Laredo (as measured by speedometer on highway). June 18–19, 1941. Arid desert type.

2. Río Ramos, 20 kilometers northwest of Montemorelos, 1,000 ft. (Camp was established at the village of Buenavista, about four kilometers southeast of Allende). June 19–21 and July 13–15, 1941; June 2–18 and August 26–September 2, 1942. Arid tropical type.

3. 12 kilometers SW Allende, 3,000 ft. (Collecting was done near the headwaters of the Río Ramos close to the settlement of Potrero de Vallejos). June 9–10, 1942. Mixed forest type.

4. 6 miles north Río Potosí (on highway, 23 kilometers northwest of Linares). June 21, 1941. Semidesert type.

5. Magueyes, Río Pilón. (Where highway crosses the river. Road sign has the name Magueyes, but map has the name Rosalia for the small settlement there). June 19, 1942. Arid tropical type.

Tamaulipas

6. 19 kilometers southwest Manté (near the village of Quintero near the headwaters of the Río Manté in the Sierra Cucharas. Manté is the town where the Tampico highway enters the Laredo-Mexico City highway). June 21, 1941. Tropical type.

San Luis Potosí

7. Axtla, 200 ft. (Camp was on the Río Axtla about two kilometers upstream from the village of Axtla and about 20 kilometers NNW Tamazunchale.) June 22–29, 1942. Tropical type.

Hidalgo

8. Jacala, about 4,500 ft. June 22 and July 12, 1941. Encinal type.

9. Río Tasquillo, 26 kilometers southeast Zimapan, about 5,000 ft. (Camp was at the highway bridge across the river and about 5 kilometers downstream from the town of Tasquillo. On some maps this is Río de Tula.) July 10–12, 1942. Arid desert type.

10. Tasquillo, 5,400 ft. (Camp was on the Río de Tula about one mile north of Tasquillo.) July 26–29, 1942. Arid desert type.

11. 85 kilometers north of Mexico City (9 km S Pachuca), 8,200 ft., at the junction of Federal Highway 1 and the road to Pachuca. August 21–24, 1942. Arid desert type.

12. 97 kilometers north of Mexico City (9 km SW Pachuca), 8,300 ft. August 18–21, 1942. Arid desert type.

México

13. Eastern edge of Lago Texcoco, 17 kilometers east of Mexico City, 7,500 ft. June 23–25, 1941; August 18, 1942. Arid desert type.

14. 22–23 kilometers east of Mexico City, 7,500 ft. July 9–10, 1941; July 29 to August 10, 1942. Arid desert type.

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[1] Numbers correspond to those on map, fig. 1.

15. 5 kilometers northwest of Texcoco, 7,600 ft. August 10–20, 1942. (On eastern marshy edge of Lago Texcoco).
16. Lago Zempoala, 45 kilometers southwest of Mexico City, (about 15 kilometers northwest of Cuernavaca, Morelos) 9,400 ft., August 13–19, 1942. Montane type.

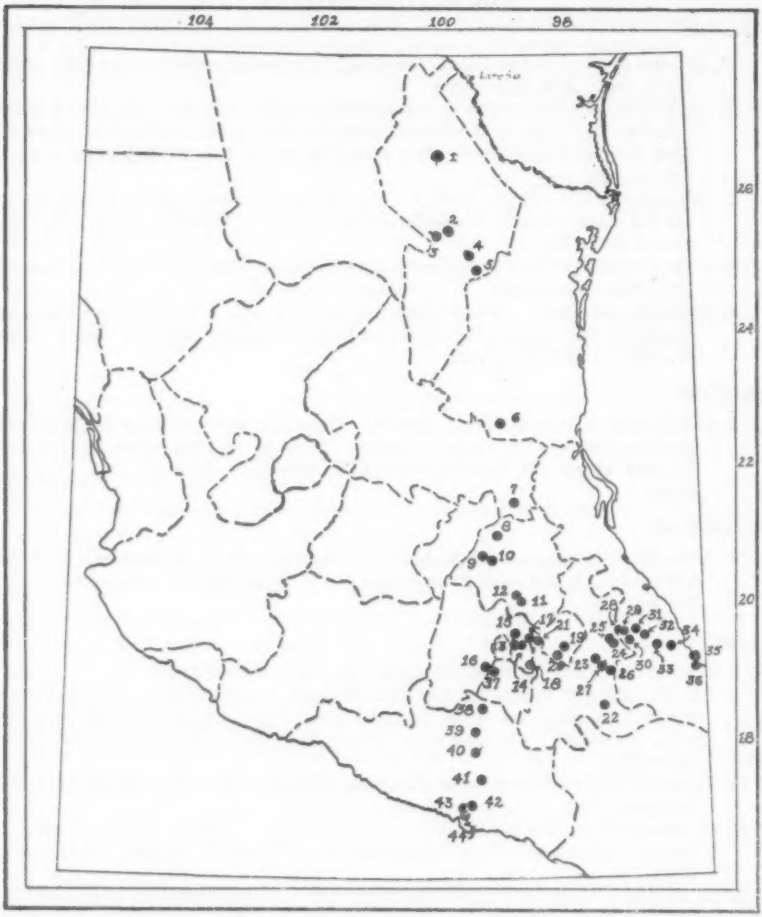

FIG. 1. Map of part of México indicating location of collecting stations listed under COLLECTING STATIONS in text. Figures on map agree with those in the list.

17. Llano Grande, Monte Río Frío range, 45 kilometers (airline; 55 kilometers on highway marker) east-southeast of Mexico City, 10,500 ft. June 23–25, 1941; June 28 to July 18, 1942. Montane type.
18. North slope of Mount Popocatepetl, 13,500 ft. July 12–22, 1942. Montane, near timber line.

Tlaxcala

19. 13 kilometers northeast of Tlaxcala, 7,800 ft. July 13–21, 1942. Arid desert type.
20. 8 kilometers southwest of Tlaxcala, 7,500 ft. July 21–25, 1942. Marsh in arid desert.

Puebla

21. Río Otlati, 15 kilometers northwest of San Martín (Texmelucan), 8,700 ft. July 18 to August 20, 1942. Mountain-desert transition.
22. 33 kilometers west of Tehuacan, 8,000 ft. July 27–28, 1942. Mountain-desert transition.
23. 4 kilometers north of San Salvador del Seco (El Seco on some maps), 8,000 ft. August 6, 1942. Old lake bed, marshy in places.
24. Laguna de las Minas, 8,000 ft. (About 2 kilometers southeast of Alchichica, near the settlement of Quecholac). August 8, 1942. Arid desert type.
25. Laguna Salada, 8,000 ft. (An old crater at side of highway at the settlement of Alchichica. Another settlement by the name of Alchichica is about 5 kilometers north of this lake). July 22–28, 1942. Arid desert type.
26. West slope of Mount Orizaba, 9–20 kilometers northeast of San Andrés (Chalchicomula), 9,000–11,000 feet. August 9–19, 1942. Montane.
27. 10 kilometers west of San Andrés (Chalchicomula), 8,300 ft. August 19, 1942. Arid desert type.

Veracruz

28. Guadalupe Victoria (Aguatepec), 8,300 ft. (6 km SW Perote). July 28 to August 1, 1942. Arid desert type.
29. Perote, 8,300 ft. July 31, 1942. Arid desert type.
30. North slope of Cofre de Perote, 10,500 ft. (Collecting was done near the settlements of Pescados and Conejo and also on the peak). July 26 to August 4, 1942. Montane.
31. Las Vigas (Vigas on some maps), 8,300 ft. August 1–8, 1942. Mountain rainforest type.
32. 5 kilometers north of Jalapa, 4,500 ft. (Collecting was done in vicinity of the settlement of San Lucas Martín on the Río Banderillo). July 1–5, 1941; July 31 to August 8, 1942. Rain forest-arid tropical transition.
33. Plan del Río, 1,000 ft. (32 km airline southeast of Jalapa on highway to Vera Cruz). July 25–31, 1942. Arid tropical type.
34. Puente Nacional, 500 ft. (on the Río Antigua). July 5–9, 1941. Arid tropical type.
35. Veracruz, 0–30 ft. July 6–9, 1941. Arid tropical type.
36. Boca del Río (10 km SE Vera Cruz at the mouth of Río Atoyac), sea level. July 16–25, 1942. Semitropical—marshy.

Morelos

37. Huitzilac, 9,050 ft. (12 km N Cuernavaca). August 11–13, 1942. Forest-desert transition.

Guerrero

38. 22 kilometers south of Taxco (near village of Tecalpulco), 4,000 ft. August 3, 1942. Semidesert type.
39. 14 kilometers northeast of Mexcala (hear Xalitla), 2,100 ft. August 4, 1942. Arid desert type.
40 Cañon del Zopilote, 16 kilometers up the Río Zopilote from the Río Balsas (Río Mezcala on some maps), 2,100 ft. August 4, 1942. Arid desert type.
41. 15 kilometers south of Chilpancingo, 4,300 ft. (Collecting also was done in the high mountains to the west.) August 14–21, 1942. Semidesert-grassland.

42. Río Xolapa (Solapa on some maps), 14 kilometers southwest of Tierra Colorada, 600 ft. (This river empties into the Río Papagallo near Tierra Colorada.) August 4, 1942. Tropical.
43. Río Aguacatillo, 30 kilometers north of Acapulco, (at La Trienta), 1,000 ft. August 3–14, 1942. Tropical.
44. 53 kilometers southwest of Tierra Colorada (by highway—near La Venta), 500 ft. August 3, 1941. Tropical.

ACCOUNTS OF SPECIES

Didelphis mesamericana tabascensis Allen.—Central American Opossum

Specimens examined: Veracruz: Boca del Río, 1; 5 km N Jalapa, 4,500 ft., 2.

The male from Boca del Río is typical of *tabascensis* (ratio of nasals to basal length, 53; ratio of tail to head and body, 108). The specimens from Jalapa, however, are intermediate between *tabascensis* of the coastal region of eastern Mexico and *mesamericana* of the central and western highlands (ratio of nasals to basal length, 49.5; ratio of tail to head and body, 98). Because of the relatively long tail, I have referred them to *tabascensis*. The buffy underfur of the abdomen, sides, and cheeks in *tabascensis* appears not to be due to adventitious staining, as suggested by Allen (1901a, p. 173), since in the specimen from Boca del Río the underparts are buffy and white, the latter color confined to the chin, throat, and a narrow streak on the chest.

Opossums of this genus were exceedingly numerous in the region between Jalapa and the Gulf of Mexico. I had occasion to drive through that section of Veracruz several times at night in July and each time from 15 to 20 opossums were seen crossing the highway. I examined several that had been killed by automobiles and most were half-grown *Didelphis*. Occasionally the smaller *Metachirops* was found.

Didelphis mesamericana mesamericana Oken.—Central American Opossum

Specimens examined: Hidalgo: Tasquillo, 5,400 ft., 3. *Puebla:* Río Otlati, 15 km NW San Martín, 8,700 ft., 1. *Guerrero:* Río Aguacatillo, 30 km N Acapulco, 1,000 ft., 1.

These specimens are *mesamericana*, with the nasals blunt posteriorly and the tail comparatively short (ratio of nasals to basal length, 48; ratio of tail to head and body, 81). All specimens are in the gray phase and the adults from Tasquillo are molting.

At Tasquillo (semi-desert type) opossums seemed to be restricted to the vicinity of the river where they were hunted by local residents with dogs. At Río Otlati (montane-desert transition) they were not common, but we saw several of their tracks along the creek. At Río Aguacatillo (tropics) they were exceedingly numerous.

The adult female from Tasquillo was suckling nine young; the August-taken young appear to be about one-fourth grown.

Didelphis mesamericana texensis Allen.—Central American Opossum

Specimen examined: Nuevo Leon: Río Ramos, 20 km NW Montemorelos, 1,000 ft., 1.

This specimen (black phase) extends southward the known range of *texensis* at least 100 miles. That it is referable to the race *texensis* is evidenced by the long nasals (51 percent of basal length), long tail (100 percent of length of head and body), and extent of black on tail (basal one-half). Allen's allocation (1901a, p. 167) of four specimens from Monterrey, about 45 kilometers northwest of the Río Ramos, to the race *marsupialis* (= *mesamericana*) should be confirmed by reexamination of the specimens. If they prove to be *mesamericana*, rather than *texensis*, it is likely that they were taken in the mountains west of Monterrey.

Opossums were numerous along the Río Ramos where they were hunted regularly with dogs by the local inhabitants.

Remarks on Relationships of American Opossums.—In his study of American opossums, Allen (1901a) referred the opossums of Mexico and the lower Rio Grande Valley of Texas to the species *Didelphis marsupialis*; those of the remainder of North America to *Didelphis*

virginiana. He states (p. 170), "It seems preferable to treat the Mexican *D. marsupialis* group as specifically separable from *D. virginiana* of the United States, although the characters that distinguish the two are mainly differences of degree . . . rather than absolute. The chief features of distinction . . . are (1) the greatly increased length of tail in the *D. marsupialis* group, with the basal half, instead of only the extreme basal portion, black; (2) absence of white on toes; (3) absence of white on ears, although a slight white edging seems liable to crop out sporadically throughout the range of the species; (4) the increased width of the apical black zone of the underfur . . .; and (5) the grayish dusky color of the whole front of the head, including the top and sides of the nose, and the presence of a well developed ocular stripe." The following year Allen (1902, p. 252) referred most of the Central American opossums to the species *D. mesamericana*, reserving the name *D. marsupialis* for the South American forms.

The characters ascribed to *virginiana*, with the one exception of white-colored toes, do not hold in all specimens examined. For example, in a series of 17 *virginiana* from east-central Texas, the ratio of length of tail to length of head and body ranges from 67 to 88 (average, 78); in two specimens the basal one-fourth of the tail (measured on scaly part) is black, in the remaining specimens the basal one-tenth to one-sixth is black; in eight, the ears are completely black, the others, black with "white" rim or big "white" blotch; in one specimen the facial region is as dusky as a specimen of *mesamericana* from central Mexico.

In a series of five specimens from Mexico in the range of the subspecies *mesamericana*, the ratio of length of tail to length of head and body ranges from 73 to 93 (average, 81); one specimen has completely black ears, the others, black, edged with white; in one specimen the basal one-fourth of the tail is black, in the others the basal one-third to one-half.

As Allen points out, no satisfactory cranial characters separate *virginiana* from *mesamericana*. The V-shaped condition of the posterior margins of the nasals is unreliable, since it also is found in *mesamericana*. Seemingly, then, the only character separating all specimens of these two forms at hand is the color of the toes—black in *mesamericana*, whitish in *virginiana*. I have not seen specimens from that part of Texas where the ranges of these two forms meet that demonstrate intergradation, but Allen must have for he states (1902, p. 256) that in *pigra*, along the Gulf Coast of Louisiana and Texas, the white on the "toes is reduced and . . . of irregular presence". Seemingly there is no good argument for maintaining *mesamericana* and *virginiana* as distinct species.

Metachirops opossum pallidus (Allen).—Quica Opossum

Specimens examined: Veracruz: Boca del Río, 6.

These specimens average considerably larger than those examined by Allen (1901b); in fact, the cranial measurements of one male are larger than in any specimen recorded by him (length of skull, 80; basilar length of Hensel, 73.5; length of nasals, 38; zygomatic breadth, 44.3; width across postorbital processes, 16.9; mastoid breadth, 25.5; length of upper tooth row (from back of canine), 26.2; length of palate, 43.1). The averages of four adult specimens, in order of measurements listed above, are: 77.0, 71.0, 36.3, 40.0, 14.9, 24.3, 26.7, 42.8. Otherwise, these specimens seem referable to *pallidus*.

This species was exceedingly abundant in the semi-marshy areas near the Gulf. Our specimens were caught in steel traps, baited with scent or carcasses of birds, set at the edge of the river where the animals foraged nightly for crabs, other crustaceans, and frogs. Several of these opossums were observed at night on the highway between Vera Cruz and Puente Nacional where they appeared to be feeding on animals that had been killed by automobiles.

Both of the adult females were carrying young in the pouch; one had five, the other seven. The two young were about three months old and one-third grown; the last two molars had not erupted.

Sorex vagrans orizabae Merriam.—Vagrant Shrew

Specimens examined: México: N Slope Mt. Popocatepetl, 13,500 ft., 1; Monte Río Frío, 55 km ESE Mexico City, 10,500 ft., 1.

The specimen from Mt. Popocatepetl was taken in a snap trap set in "sacaton" grass about

100 yards from a spring; the one from Monte Río Frío was recovered from the stomach of a red-tailed hawk (*Buteo jamaicensis calurus*). Both specimens were in full summer pelage.

Sorex saussurei saussurei Merriam.—Saussure Shrew

Specimens examined: México: Lago Zempoala, 45 km SW Mexico City, 9,400 ft., 3. *Puebla:* Río Otlati, 15 km NW San Martín, 8,700 ft., 1.

These shrews were taken in snap traps set in tall sacaton grasses in rocky situations near water. None was in breeding condition.

The specimen from Río Otlati is atypical in that certain cranial measurements exceed those of any specimen of the species *saussurei* recorded by Jackson (1928)—condylobasal length, 18.3; palatal length, 8.0; cranial breadth, 9.0; interorbital breadth, 4.1; maxillary breadth, 5.6; maxillary tooth row, 7.0. Also, the cranium is more highly arched than in the specimens from Lago Zempoala.

Cryptotis parva berlandieri (Baird).—Least Short-tailed Shrew

Specimen examined: Veracruz: Boca del Río (8 km S Vera Cruz), 1.

This specimen, an adult male, weighing 5.3 grams, with enlarged testes and worn teeth, is inseparable specifically from *Cryptotis parva* of the United States. In the shallow excavation behind M^1 and M^2 and the more highly developed hypocone on each of these teeth, it resembles *C. p. berlandieri* from the Lower Rio Grande Valley. For this reason and also because I have not had available for comparison specimens of *Cryptotis micrura*, to which species Merriam (1895a) referred specimens from the lowlands of southern Veracruz, I am referring this specimen tentatively to *berlandieri*.

The animal was dug out of a burrow in a sand bank by a small Mexican boy who brought it into our camp.

Cryptotis alticola (Merriam).—Mountain Short-tailed Shrew

Specimen examined: México: Monte Río Frío, 45 km ESE Mexico City, 10,500 ft., 1.

This little-known, mountain-dwelling, short-tailed shrew is much darker, more blackish, than any of the *parva* group of the lowland region skirting the Gulf of Mexico. This character, the larger hind foot, and larger skull (upper tooth row, 8.5 mm; greatest length of lower jaw, including incisors, 13.5 mm) readily separate the two species.

This specimen was captured in an unbaited snap trap set crosswise in the open runway of *Microtus mexicanus* in a short-grass meadow bordered with pines. The string of traps had been in operation at the same sites for a period of six days and it was not until the population of meadow mice had been drastically reduced that the shrew was caught.

Balantiopteryx plicata Peters.—Sac-winged Bat

Specimens examined: Veracruz: Puente Nacional, 10. *Guerrero:* Río Aguacatillo, 30 km N Acapulco, 1,000 ft., 1; Cañon del Zopilote, 16 km from Río Balsas, 2,100 ft., 1; 14 km NE Mexcala, 2,100 ft., 1; Río Xolapa, 14 km SW Tierra Colorada, 600 ft., 7.

These small, "bluish" bats are cave-dwellers, large numbers of them occurring together in favored sites. At Puente Nacional, several hundred of them, all females with young or in advanced stages of pregnancy, occupied a series of small caves in a rocky bluff a short distance down stream from the village. They were the only occupants of these caves. In a large cave near the road in the Cañon del Zopilote, they shared quarters with a large colony of vampire bats (*Desmodus*), but each kind occupied a different section of the cave. At the locality south of Tierra Colorada, several hundred of them occupied a stone culvert under the highway, the entrances to which were shielded by rank vegetation that prevented much of the light from entering. Seemingly these bats are restricted to elevations below 2,500 feet.

In roosting, the bats hang singly, the wings partly wrapped around the body. They are relatively unafraid of man and may be observed at close range. Seldom do they seek crevices; they seem to prefer to hang fully exposed from the walls or ceiling of their retreat.

They emerge from their roosts early in the evening, often before sunset, and begin for-

aging. Their flight is erratic, but relatively slow. In these respects they remind one of *Pistrellus hesperus*, which is about the same size.

The young are born in late June or early July, one being the usual number. The young at birth weigh about two grams, nearly one-third as much as an adult, non-pregnant female. This ratio of weight of young to weight of mother is exceedingly high. In summer, at least, the adult males and females occupy different roosts.

Sanborn (1937) implies that *plicata* is restricted to the Pacific slopes of Central America from Lower California to Costa Rica. The specimens from Puente Nacional, Veracruz, however, indicate that its range also extends into the lowlands of eastern México.

When first examined, the Veracruzan specimens were thought to be *Balantiopteryx io*, but comparison with *plicata* from Guerrero reveals that they differ only in average browner color. Furthermore, they are much larger than *io* as judged by measurements recorded by Sanborn (*loc. cit.*). This is clearly evident in Table 1.

The weight of non-pregnant adult females averaged 7 grams, with extremes of 6.6 and 8.3; males, 5.7 grams, with extremes of 5 and 6.

TABLE 1.—*Measurements of Balantiopteryx*

	FOREARM	TIBIA	LENGTH OF SKULL[1]	WIDTH OF ROSTRUM	REMARKS
B. io	35.6–38.8	14.0–15.9	12.4–12.9	5.7–6.2	After Sanborn
B. plicata	39.0–44.7	16.9–20.2	13.0–14.8	6.3–7.0	After Sanborn
Veracruz	38.9–41.7	16.3–17.1	13.3–13.5	6.3–6.7	10 females
Guerrero	39.0–41.5	16.9–18.1	13.7–14.2	6.4–6.8	2 females, 8 males

[1] Greatest length from front of canines.

Glossophaga soricina leachii (Gray).—Long-tongued Bat

Specimen examined: Guerrero: Río Xolapa, 14 km SW Tierra Colorada, 600 ft., 1.

On August 4, five or six individuals of this species were found in a large culvert under the highway. In common with other phyllostomid bats with which I am familiar, these were exceedingly wary and I succeeded in taking only one male, weighing 8.0 grams. The others flew out of the culvert and disappeared. Although I examined every culvert between this locality and Tierra Colorada, no other bats of this species were found.

Glossophaga soricina alticola, subsp. nov.—Long-tongued Bat

Type.—Male, adult, skin and skull; no. 2911 Texas Cooperative Wildlife Collection; 13 kilometers northeast of Tlaxcala, 7,800 feet, Tlaxcala; collected July 14, 1942, by Harry L. Gilbert, original number 36.

Diagnosis.—Similar to *G. s. leachii* (Gray), but darker, heavier, slightly larger, and with conspicuously larger thumb. Skull similar to that of *leachii*, but incisors less forward projecting, the anterior outline of same, as viewed from above, slightly convex rather than nearly semicircular.

Measurements.—(Male first, female second) Total length, 66, 67; length of tail, 6, 6; length of hind foot, 11, 11; height of ear from notch, 14.5, 14.0; length of forearm, 37.6, 37.3; condylobasal length, 19.5, 19.3; rostral breadth, 4.5, 4.7; breadth of braincase, 8.8, 8.7; length of maxillary tooth row, 7.6, 7.3.

Remarks.—This bat is clearly related to *leachii*, but the longer thumb (7.7 mm as opposed to 5.0), darker color (dark grayish brown, rather than light brown), greater weight (12 grams as opposed to 8), and arrangement of the incisor teeth clearly separate it from *leachii*.

Our specimens were taken in a natural cave in the side of a rocky canyon wall, which it shared with the larger *Chæronycteris mexicana*. Both species were wary and difficult to approach.

Specimens examined.—Two from the type locality.

Chœronycteris mexicana Tschudi.—Long-tongued Bat

Specimens examined: Hidalgo: Río Tasquillo, 26 km E Zimapan, 5,000 ft., 5. *Tlaxcala:* 13 km NE Tlaxcala, 7,800 ft., 5.

This "fox-headed", long-tongued bat occurred in considerable numbers at these two localities, both of which are in the arid section of the Mexican Plateau. The species is a cave-dweller, often choosing as a daytime retreat small caves and recesses in the rocks into which considerable light can penetrate. Colonies of several dozen is the rule, but we also found them hanging singly and in groups of two to five.

This species is by far more wary than any other bat with which I am familiar. The sense of sight is well developed and when the bats are molested during daylight hours they do not hesitate to abandon their retreat and seek other shelter.

In contrast to most North American cave bats, the males and females of this species frequently roost together. Also, they are sexually dichromatic, the females being sooty in color, the males reddish brown.

Artibeus jamaicensis jamaicensis Leach.—Big Banana Bat

Specimen examined: Veracruz: Plan del Río, 1,000 ft., 1.

In a cavern in the face of a high bluff, several of these large, tailless, leaf-nosed bats were encountered, but they were so wary that only one specimen, an adult male weighing 48.1 grams, was captured. Local inhabitants informed us that they fed in a nearby banana grove.

Artibeus toltecus toltecus (Saussure).—Small Banana Bat

Specimens examined: Veracruz: Plan del Río, 1,000 ft., 3.

These small, tailless, leaf-nosed bats utilized a small banana grove at the head of a spring as a daytime retreat. There they had regularly established roosts under the large, drooping leaves of the banana trees, each one easily recognized by the manner in which the vane of the leaf hung limply suspended from the midrib. The closely appressed vanes of the leaf, plus the natural darkness within the depths of the grove, afforded good concealment. These bats, too, were wary and that feature coupled with the nature of their retreat caused considerable difficulty in procuring specimens.

Desmodus rotundus murinus Wagner.—Vampire Bat

Specimens examined: Hidalgo: Jacala, 4,000 ft., 6. *Veracruz:* 5 km N Jalapa, 4,500 ft., 14. *Guerrero:* Cañon del Zopilote, 16 km from Río Balsas, 2,100 ft., 1.

Our experience with this species indicates that it inhabits caves at middle altitudes in México, but we also found it occupying an unused mine tunnel at Jacala and cave-like recesses in the ruins of a large stone building at Jalapa. The species is colonial, large numbers crowding into favored roosting sites. Frequently it shares a cave with other bats, but never roosts with them. The presence of this species is readily detected by the strong odor of ammonia emanating from the dark, sticky, viscous feces—one result of their diet of blood.

In the mine tunnel at Jacala, on June 22, we found more than 100 of these bats, mostly females and young of the year, the latter about one-third grown and weighing about 40 percent as much as adults. Two weeks later their weight had increased to 60 percent that of adults. Here and at Jalapa both adult males and females occupied the same roost in summer. This bat is wary, vicious, and capable of inflicting painful wounds if handled carelessly.

Weights of adults ranged from 32 to 47 grams (average, 37).

Myotis velifer velifer (Allen).—Cave Bat

Specimens examined: Veracruz: 5 km N Jalapa, 4,500 ft., 4. *Tlaxcala:* 13 km NE Tlaxcala, 7,800 ft., 1; 8 km SW Tlaxcala, 7,500 ft., 10. *México:* Monte Río Frío, 45 km ESE Mexico City, 10,500 ft., 1; Lago Zempoala 45 km SW Mexico City, 9,400 ft., 4.

At Jalapa and at the locality southwest of Tlaxcala, bats of this species were roosting in the ruins of large stone buildings, using cavities in the walls as retreats. At Río Frío and Lago

Zempoala, the specimens taken were shot in the evening at pools of water in the coniferous forest where they had come to drink. Only at the locality northeast of Tlaxcala were *velifer* encountered in a natural cave. They shared it with *Chæronycteris mexicana* and *Myotis californicus*. Seemingly this is the most common *Myotis* occupying the highlands of México.

Myotis californicus mexicanus (Saussure).—California Little Brown Bat

Specimens examined: Tlaxcala: 13 km NE Tlaxcala, 7,800 ft., 3.

This dark, small-footed bat is not of common occurrence in the highlands of Mexico. In two seasons of collecting, we encountered it only at the above locality where it shared a cave as a roosting site with the long-tongued bat, *Chæronycteris mexicana*, and the cave bat, *Myotis velifer*.

Of the three specimens taken July 16–20, two are adults, one of each sex, weighing 5.0 grams each; the third is a half-grown female.

Myotis yumanensis lutosus Miller and Allen.—Yuma Bat

Specimen examined: Hidalgo: Río Tasquillo, 26 km E Zimapan, 1.

This specimen, weighing 5.3 grams, was obtained at the bottom of the canyon of the Río Tasquillo where it occurred with *Pipistrellus hesperus*. Because both species did not emerge from their hiding places in the walls of an abandoned stone house until nearly dark, they were difficult to capture. The occurrence of *lutosus* at this locality extends the known range of the race considerably to the southeast. Previous records are from Jalisco, Michoacan, San Luis Potosí, and Zacatecas (see Miller and Allen, 1928).

Myotis lucifugus lucifugus (Le Conte).—Little Brown Bat

Specimen examined: México: 5 km NW Texcoco, 7,600 ft., 1.

To my knowledge this is the only specimen of the species *Myotis lucifugus* known from the highlands of south-central México. On geographic grounds, it should be referred to the subspecies *fortidens*, but according to Dr. David H. Johnson of the U. S. National Museum who examined it, "in spite of its being far out of the expected range, it seems to be nearest *Myotis lucifugus lucifugus*. The skull definitely lacks the peculiar arrangement of the premolars on which *Myotis lucifugus fortidens* is based." This bat weighed 6.9 grams.

Pipistrellus hesperus australis Miller.—Canyon Bat

Specimen examined: Hidalgo: Río Tasquillo, 26 km E Zimapan, 1.

This specimen, weighing 3.0 grams, was taken in the canyon of the Río Tasquillo, where it occurred with *Myotis yumanensis lutosus*. Miller (1897) described this race on the basis of four specimens from Jalisco. Hatfield (1936), in his revision of *Pipistrellus hesperus*, indicates that *australis* is restricted to western México, west of the Sierra Madre. The presence of *australis* at Zimapan extends the known distribution of the species some 150 miles to the east on the Mexican plateau.

Eptesicus fuscus fuscus (Beauvois).—Big Brown Bat

Specimens examined: Nuevo Leon: Río Ramos, 1,000 ft., 20 km NW Montemorelos, 5.

On June 10, 1942, a colony of big brown bats was located in a cavity in a large cypress tree near the river. This retreat served not only as a roosting place for adults but also as a nursery. Each of the females taken was lactating; the young were approximately one week old.

On the basis of geographic distribution, I had expected these bats to be referable to the race *pallidus*, but their darker color precludes such treatment. Their affinity is with the eastern race *fuscus*, although certain individuals suggest that the population consists in part of intergrades between *pallidus* and *fuscus*.

Eptesicus fuscus miradorensis (H. Allen).—Big Brown Bat

Specimens examined: México: Monte Río Frío, 10,500 ft., 45 km ESE Mexico City, 2; Lago Zempoala, 45 km SW Mexico City, 9,400 ft., 1. *Tlaxcala:* 13 km NE Tlaxcala, 7,800

ft., 5. *Puebla:* Río Otlati, 15 km NW San Martín, 8,700 ft., 1; W slope Mt. Orizaba, 10,000 ft., 1. *Veracruz:* 5 km E Las Vigas, 8,000 ft., 1; 5 km N Jalapa, 4,500 ft., 1.

Seemingly this dark-colored big brown bat is restricted to the more temperate parts of southern México (altitudes 4,000–11,000 ft.), where it usually is associated with trees, about which it feeds. It is one of the common bats in the coniferous forests but is seldom found in the semi-arid parts of the Mexican Plateau.

Young taken in late July and early August had nearly reached adult proportions, except in weight: adults averaged 20.6 grams; young, 13.4 grams.

Nycticeius humeralis mexicanus, subsp. nov.—Evening Bat

Type.—Female, adult, skin and skull; no. 2801, Texas Cooperative Wildlife Collection; Río Ramos, twenty kilometers northwest of Montemorelos, 1,000 feet elevation, Nuevo Leon; collected June 6, 1942, by W. B. Davis, original no. 3921.

Diagnosis.—Similar to *humeralis* of eastern Texas, but decidedly lighter in color; upper parts rich fuscous brown as in the big brown bat, *Eptesicus fuscus*; underparts paler; membranes of ear less heavily pigmented than in *humeralis*. Skull: Similar to *humeralis*, but averaging longer and with occipital region more highly inflated.

Measurements.—Total length, 94 (89–97); length of tail, 35 (30–38); length of hind foot, 8.0 (7.8–9.0); length of forearm 35.4 (33.7–36.6); greatest length of skull, 14.3 (14.0–14.7); zygomatic breadth, 9.8 (9.5–10.3); mastoid breadth, 8.2 (8.0–8.5); occipital height, 5.5 (5.3–6.1); length of maxillary tooth row, 5.5 (5.3–5.6); weight (non-pregnant), 9.6 grams.

Remarks.—This race differs markedly from *humeralis* only in color, all specimens taken being much browner, less blackish, than specimens from eastern Texas. Certain Texas specimens approach *mexicanus* in being brownish, but the palest specimen is much darker than the darkest one from the Río Ramos.

These bats occupied cavities in large cypress trees bordering the river; specimens were taken with the aid of long forceps. All were females, either gravid or nursing newly born young. They emerged from their retreats about sundown and foraged for insects along the stream, often dipping close to the water. This was the most common bat in the area, outnumbering *Myotis yumanensis* and *Tadarida mexicana*.

Specimens examined.—Ten, all from the type locality.

Corynorhinus rafinesquii mexicanus G. M. Allen.—Lump-nosed Bat

Specimens examined: Hidalgo: Río Tasquillo, 26 km E Zimapan, 5,200 ft., 1. *México:* Monte Río Frío, 55 km ESE Mexico City, 10,500 ft., 1.

The specimen from Hidalgo was taken while in flight at the bottom of the canyon through which flows the Río Tasquillo; the vegetational association was semi-desert. The one from Monte Río Frío was taken as it was flying about a rain pool in an opening in the pine-fir forest. Seemingly the distribution of this bat is not correlated closely with any one biotic association. The specimen from near Zimapan lacks the pointed cusps on the inner upper incisors that Allen (1916) considers characteristic of this race; it is present in the other one.

Antrozous pallidus pallidus (Le Conte).—Pallid Cave Bat

Specimen examined: Nuevo Leon: Maguayes, Río Pilon, 1.

A single female, carrying two nearly half-grown young attached to her nipples, was taken on June 19 from a cavity in a dead cypress tree near the river. Several of these bats were using the cavity as a daytime retreat and nursery.

Tadarida mexicana (Saussure).—Mexican Free-tailed Bat

Specimens examined: Nuevo Leon: Río Ramos, 20 km NW Montemorelos, 1,000 ft., 3. *Tlaxcala:* 8 km SW Tlaxcala, 7,500 ft., 5. *Veracruz:* 5 km N Jalapa, 4,500 ft., 1; 5 km E Las Vigas, 8,000 ft., 1.

This bat is common and widespread in Mexico, occupying an altitudinal range from near

sea level to at least 8,000 feet. Our observations suggest that it is restricted largely to desert and semi-desert areas, occurring rarely in the tropics. We have found it in caves, as at Las Vigas, in walls of rock buildings, and, at the Río Ramos, a colony of females, each one taken (June 5–12) containing one nearly full term foetus, occupied a cavity in a large cypress tree overhanging the river.

Nasua narica tamaulipensis Goldman.—Coati

Specimens examined: Nuevo Leon: 12 km W Allende, 3,000 ft., 1. *Tamaulipas:* 19 km SW Manté, 1.

In the canyon through which the Río Ramos enters the coastal plain, members of our party observed a group of seven coatis feeding on a fern-covered, rocky ledge. When molested, they sought cover in a small cave in the canyon wall. Next day, farther upstream, one large male, estimated to weigh nine pounds, was shot from an oak tree in which it had been feeding.

At our various camps in the state of Veracruz we were unsuccessful in determining the occurrence of coatis; the local residents stated that they knew the animal we described, but that it occurred "far away in the mountains".

Bassariscus astutus astutus (Lichtenstein).—Ring-tailed Cat

Specimens examined: Veracruz: 5 km N Jalapa, 4,500 ft., 1; 5 km E Las Vigas, 8,000 ft., 1. *Puebla:* Río Otlati, 15 km NW San Martín, 8,700 ft., 3.

Ring-tailed cats occur at middle altitudes in central México where suitable den sites in the form of crevices in rocky ledges are available. At the Río Otlati camp their tracks were observed daily along the pine-bordered stream and they were observed at night crossing the highway near Taxco, Guerrero, and on the western slope of the Monte Río Frío range, 30 kilometers east of Mexico City.

All the females (four) taken in late July and the first week in August were lactating, suggesting that in this region the young are born in June and July.

Females from the Río Otlati region are grayer, with less suffusion of brown on the rump, than those from Jalapa and Las Vigas. The male from Río Otlati, however, has the brownish suffusion. The specimen from Jalapa differs from the others in that dorsally the white rings on the tail are reduced and less conspicuous. Also, the black rings completely circle the tail, whereas in specimens from the highlands the black rings on the terminal half of the tail are not complete, producing ventrally a continuous white stripe as in *B. a. flavus*.

Mustela frenata frenata Lichtenstein.—Bridled Weasel

Specimen examined: Nuevo Leon: Río Ramos, 20 km NW Montemorelos, 1,000 ft., 1.

This specimen, an adult male weighing 340 grams, was captured by hand and drowned while it was swimming across the river in broad daylight (for details see Davis, 1942).

Mustela frenata tropicalis (Merriam).—Bridled Weasel

Specimen examined: Veracruz: 5 km N Jalapa, 4,500 ft., 1.

This specimen, a half-grown male, was captured July 3 at dusk on the highway where it had been injured by a passing automobile. It was acquiring permanent premolars. Although not typical of *tropicalis* in that the black color does not extend half way to the shoulder from the ear, it is here tentatively referred to that race on geographic grounds.

Mustela frenata perotae Hall.—Bridled Weasel

Specimens examined: México: Monte Río Frío, 45 km ESE Mexico City, 10,500 ft., 2; N slope Mt. Popocatepetl, 13,500 ft., 1. *Puebla:* Río Otlati, 15 km NW San Martín, 8,700 ft., 1.

Externally, the specimens from Monte Río Frío are indistinguishable from the race *M. f. frenata*, as known to me by specimens from Nuevo Leon and the Rio Grande section of Texas. On the basis of cranial characters, however, they are referable to *perotae*. The bulla is short

and low, and its height is less than the distance from its anterior end to the foramen ovale. The other two specimens agree with *perotae* in color as well as in cranial characters. The zygomatic breadth is greater than the distance from the anterior palatine foramen to the anterior end of the auditory bulla and the throat and breast are ochraceous buff, not white. Seemingly, the weasels at the higher altitudes east of the Valley of Mexico are intergrades between *perotae* and *frenata* with the characters of *perotae* dominating.

Weasels were common in the coniferous forests east of Mexico City. They seemed to be most abundant in meadows occupied by ground squirrels, pocket gophers, meadow mice, and other small rodents on which they prey, but I encountered one at 11,000 feet on Mt. Popocatepetl in a dense stand of pines and firs. An adult female was caught in a gopher trap set in the burrow of the large mountain gopher, *Cratogeomys merriami*.

Measurements.—Adult male from Monte Río Frío: Total length, 508; length of tail, 210; length of hind foot, 50; weight, 430 grams. Adult female from Monte Río Frío: 400–150–41; weight, 215 grams.

Inasmuch as our adult male is the first one available for study, cranial measurements are included. Basilar length, 52.0 mm; length of upper tooth row, 18.4; breadth of rostrum across lacrimal processes, 15.5; interorbital breadth, 12.7; orbitonasal length, 17.5; mastoid breadth, 27.5; zygomatic breadth, 33.5; length of tympanic bulla, 16.5; breadth of tympanic bulla, 9.2; depth of tympanic bulla, 2.3; depth of skull at posterior border of upper molars, 15.5. The skull, without lower jaws, weighed 4.6 grams.

Mephitis macroura macroura Lichtenstein.—Hooded Skunk

Specimens examined: Puebla: 6 km NE San Andrés, SW slope of Mt. Orizaba, 9,000 ft., 2. *Guerrero:* 22 km S Taxco, 4,000 ft., 1.

Hooded skunks are fairly common on the Mexican tableland where their flesh is considered a table delicacy by some of the Mexicans.

The two specimens from Mt. Orizaba, taken on August 11 in steel traps set at the mouth of a burrow in a corn field, were about half-grown. Although they probably are litter mates, one individual's back and tail are entirely black, the other, white, as they are on the adult female from Guerrero.

Conepatus mesoleucus mesoleucus (Lichtenstein).—Hog-nosed Skunk

Specimen examined: Puebla: Río Otlati, 15 km NW San Martín, 8,700 ft., 1.

At this locality an adult female weighing 1,700 grams was taken on July 28 in a steel trap set at the entrance to a crevice in a rocky ledge near the creek. Her nipples indicated that she had weaned a litter of young not long before. We found this species to be less common on the Mexican tableland than the hooded skunk, *Mephitis*.

Urocyon cinereoargenteus colimensis Goldman.—Gray Fox

Specimen examined: Guerrero: 15 km S Chilpancingo, 4,300 ft., 1.

Gray foxes were observed crossing the highway at night on several occasions in the mountains east of the Valley of Mexico at altitudes ranging from 8,000 to 9,500 feet, but none was taken. They were reported as present at most of our camps in the Mexican highlands.

Citellus mexicanus mexicanus (Erxleben).—Mexican Ground Squirrel

Specimens examined: México: 5 km NW Texcoco, 7,600 ft., 5; Monte Río Frío, 45 km ESE Mexico City, 10,500 ft., 18.

In the "llano grande" at the divide east of Mexico City, *mexicanus* was abundant. There, as well as at the locality near Texcoco, they competed with the large pocket gopher, *Cratogeomys merriami*, for the green vegetation in the meadows and frequently they made use of abandoned burrows of the gopher. In the light of our experience, Howell's statement (1938, p. 119) that the zonal range of this subspecies is "Lower Sonoran" must be revised. The locality at 10,500 feet in the Monte Río Frío is distinctly boreal.

As early as June 28, numerous half-grown young were observed at the Monte Río Frío locality, suggesting that the breeding season there does not differ materially from that of the subspecies (*parvidens*) occurring in Texas.

Specimens from 10,500 feet are noticeably darker than those from the floor of the Valley of México at Texcoco. Also, the interpterygoid space and the width of the palate between the molars are distinctly narrower. These differences suggest that the mountain dwelling population represents an undescribed geographic race.

Citellus mexicanus parvidens (Mearns).—Mexican Ground Squirrel

Specimen examined: Nuevo Leon: 6 mi. N Río Potosí (23 km NW Linares), 1.

This specimen, which was dug out of its burrow at the side of the highway on June 21, had enlarged nipples, indicating that she had suckled a litter of young earlier in the season. Seemingly, this constitutes the southernmost record of *parvidens* in Nuevo Leon.

Citellus variegatus variegatus (Erxleben).—Rock Squirrel

Specimens examined: Hidalgo: Río Tasquillo, 26 km E Zimapan, 5,000 ft., 3. *Puebla:* Río Otlati, 15 km NW San Martín, 8,700 ft., 1; 33 km W Tehuacan, 8,000 ft. (estimated), 2.

Rock squirrels have a spotty distribution on the Mexican Plateau, ranging altitudinally from 5,000 to 9,000 feet, and are restricted to semi-arid, rocky habitats. Occasionally, and in small numbers, they occupy rocky situations in the oak-pine community, as at the Río Otlati station where only two individuals, presumably a mated pair, were observed. At the Río Tasquillo locality, where the precipitous nature of the terrain afforded excellent protection and concealment, they were abundant.

The ease with which these squirrels ascend and descend vertical rocky cliffs is amazing. Although usually taking advantage of crevices and cracks in moving about over the face of a cliff, they do not hesitate to scale a seemingly smooth surface when occasion demands.

Squirrels taken at 5,000 feet (July 12) were farther advanced in the reproductive cycle than individuals taken July 25-28 at elevations 3,000 to 4,000 feet higher. At the lower elevation, females were suckling young, whereas at the Río Otlati and Tehuacan stations the two females taken contained embryos; one had seven, 20 mm in rump-crown length. Specimens from the Río Tasquillo have the faded, brown summer pelage on the rump; those from higher elevations are just beginning to enter this stage.

Citellus perotensis (Merriam).—Perote Ground Squirrel

Specimens examined: Veracruz: Guadalupe Victoria, 8,300 ft., 5; Perote, 8,300 ft., 2. *Puebla:* 4 km N San Salvador del Seco, 8,000 ft., 1; Laguna de las Minas (near Alchichica), 8,000 ft., 2.

These small, spotted ground squirrels were abundant in the semi-desert region immediately north and west of the Perote-Orizaba mountains, occupying a range considerably larger than that outlined by Howell (1938, p. 132). They prefer sandy areas, but are by no means restricted to them. Their presence in the old lake bed, now semimarshy in places, north of San Salvador del Seco suggests that the range of the subspecies may connect with that of *spilosoma* by way of the northern rim of the Mexican tableland, which offers considerable habitat suitable to them.

Young of the year about one-third grown were taken on July 30. Most of the adult females examined, however, were pregnant, one taken July 27 having seven embryos 19 mm in crown-rump length; another, taken July 31, having six. These data indicate either a late breeding season or two litters a year. We saw very few young ones, however, which supports the supposition of a late breeding season. Furthermore, none of these squirrels was exceedingly fat, as are related forms in the United States at this time of the year.

Sciurus negligens Nelson.—Little Gray Squirrel

Specimens examined: San Luis Potosí: Axtla, 200 ft., 2.

These small squirrels were at home in the tall mango trees bordering the Río Axtla, shar-

ing the area with the larger, more conspicuous, and seemingly more numerous red-bellied squirrel. Their dark color blended well with the darkness in the profusely foliaged mango trees, making them inconspicuous except when they were in motion.

Our specimens, both males with testes scrotal and much enlarged, appear to be intermediate in color between S. *negligens* and *S. deppei*, suggesting that these two forms are conspecific.

Sciurus aureogaster aureogaster Cuvier.—Red-bellied Squirrel

Specimens examined: Veracruz: 5 km N Jalapa, 4,500 ft., 6; Puente Nacional, 500 ft., 1; N slope Cofre de Perote, 10,500 ft., 1. *San Luis Potosí:* Axtla, 200 ft., 5.

Red-bellied squirrels were common at the above-mentioned localities, often frequenting corn fields where they fed upon the ripening corn. At Jalapa, squirrel hu ting is a common pastime of the local hunters, many of whom are proficient with their muzzle-loading guns.

Most of our July-taken specimens were molting. Irregularly placed patches of new hair on the back and rump are interspersed with the worn pelage, but, in general, the new hair appears first on the head, then on the back, and finally on the rump and belly. A definite molt line is present in some individuals, absent in others.

Females taken in late July were suckling young; one taken July 2 contained two embryos 10 mm in crown-rump length. One young-of-the-year was nearly adult in size as judged by external measurements, but weighed only 293 grams. Another, a pure black young male with abdominal testes, weighed 353 grams. Adults weighed from 429 to 605 grams. These data indicate two breeding seasons a year in this species.

Although taken in the range assigned to *S. a. frumentor* Nelson, the specimen from the Cofre de Perote is indistinguishable from *aureogaster* taken at Jalapa.

Sciurus poliopus effugius Nelson.—White-footed Squirrel

Specimens examined: Guerrero: 15 km SW Chilpancingo 9,000 ft., 3.

This strikingly colored squirrel is fairly common in the cloud forests on the high mountains southwest of Chilpancingo. One of the females, taken August 16, had been suckling young; the other, taken the same day, had two well-developed embryos, one in each horn of the uterus.

Sciurus nelsoni hirtus Nelson.—Nelson Squirrel

Specimens examined: México: N slope Mt. Popocatepetl, 10,000–13,500 ft., 3; Monte Río Frío, 45–55 km ESE Mexico City 10,500 ft., 13.

The Nelson squirrel is, in our experience, restricted to the high mountains, occupying an altitudinal range east of the Valley of Mexico from 10,000 feet to timberline at 14,000 feet. At the lower altitudes it frequents mixed forests of oaks and pines, but above 11,000 feet it lives in forests of pines and firs. It is secretive in habit, seldom announcing its presence vocally.

Seemingly this squirrel breeds only once each season and that early in the year. Adult females taken in July had large teats indicating that they had nursed young ones earlier in the season, but no small young squirrels were observed. Two males with abdominal testes and weighing only 408 and 436 grams (adults weighed from 526 to 614 grams) probably were young-of-the-year, but they had attained adult proportions and permanent dentition.

Sciurus socialis cocos Nelson.—Acapulco Squirrel

Specimens examined: Guerrero: Río Aguacatillo, 30 km N Acapulco, 1,000 ft., 2.

Tree squirrels were not common at this station. Those present were restricted to the vicinity of the river where large trees were growing. The adult female taken August 7 weighed 505 grams and had enlarged nipples and probably was still nursing young ones. An immature female, taken August 13, had adult proportions, but weighed only 60 percent as much as an adult.

Sciurus oculatus oculatus Peters.—Black-backed Squirrel

Specimens examined: Veracruz: N slope Cofre de Perote, 10,500 ft., 5.

Largest of the tree squirrels (average weight, 638 grams) encountered by us in Mexico, this species appears to be restricted to the pine forests at the higher altitudes. Superficially, it resembles *Sciurus nelsoni* of the mountains encircling the Valley of Mexico, but differs in having one, rather than two, upper premolars, as well as in other respects.

On the timbered slopes of Cofre de Perote and Mt. Orizaba, this was the common squirrel. Females taken in July and August had enlarged nipples, indicating an earlier litter of young, but no recognizable young-of-the-year were observed. None of the females taken was pregnant.

Sciurus alleni Nelson.—Allen Squirrel

Specimens examined: Nuevo Leon: Río Ramos, 20 km NW Montemorelos, 1,000 ft., 2.

Tree squirrels were not common at this station, only four being observed by members of our party. They frequented the large cypress trees, many of which contained cavities, along the river. Local residents reported that occasionally these squirrels entered the corn fields, doing considerable damage to the ripening corn. Both of our specimens are adult males.

Thomomys umbrinus orizabae Merriam.—Mountain Pocket Gopher

Specimens examined: Puebla: 10–16 km NNE San Andrés, west slope Mount Orizaba, 10,000–11,000 ft., 5.

These small pocket gophers were fairly numerous in the openings in the forest at this locality, outnumbering the larger *Cratogeomys*. In our experience *Thomomys* occupies the higher parts of the mountain, *Cratogeomys*, the lower, with a broad belt of overlapping of ranges. In this belt the burrows of the two often are close together.

Only one of our specimens is pure black, one is nearly black; the others are bright burnt umber dorsally. Bailey (1915) reports that 14 of the 16 specimens examined by him were glossy black.

All four specimens taken August 9–15 are females, none of which was lactating or contained embryos. Two of them appear to be nearly full-grown young.

Bailey's statement (*op. cit.*) that the total length of five females averages 132 mm was probably a misprint as all of our specimens measured more than 175 mm.

Thomomys umbrinus vulcanius Nelson and Goldman.—Mountain Pocket Gopher

Specimens examined: México: N slope Mt. Popocatepetl, 13,500 ft., 14. *Puebla:* Río Otlati, 15 km NW San Martín, 8,700 ft., 8.

Nelson and Goldman (1934a) described as *Thomomys umbrinus vulcanius* a single specimen from 12,900 feet on Mount Popocatepetl. The specimens from the Río Otlati are indistinguishable both externally and cranially from the series taken at timberline on Mount Popocatepetl (see measurements, Table 2). The average differences of a millimeter or two in the two series are not significant statistically. For this reason it seems necessary to consider them as representing the same race.

In using the name *vulcanius* for these specimens I am assuming for the present that the specimens from the Río Otlati locality are different from *T. u. martinensis* Nelson and Goldman, based upon two specimens from San Martín (Texmelucan), Puebla. The fact that I observed burrows of *Thomomys* between San Martín and the Río Otlati station, however, leads me to predict that additional specimens will demonstrate that *martinensis* and *vulcanius* are inseparable, in which case the name *martinensis* will have priority.

At timber line on Mount Popocatepetl, this small gopher occurred with the larger *Cratogeomys*, their burrows often being in close proximity to each other. Seemingly, there was little direct conflict between them; both kinds were abundant. This observed distributional relationship tends to negate the suggestion made by Nelson and Goldman that *Cratogeomys* restricts the movement of *Thomomys*, effectively isolating them in restricted areas.

In mid-July, young of an earlier litter were about half-grown; two females taken in late July were lactating and a third contained two embryos 10 mm in rump-crown length.

Cratogeomys merriami merriami (Thomas).—Merriam Pocket Gopher

Specimens examined: México: Valley of Mexico, 10–17 km SE Mexico City, 7,600 ft., 2; Monte Río Frío, 45 km ESE Mexico City, 10,500 ft., 14; N slope Mount Popocatepetl, 13,500 ft., 2.

I am unable to observe any constant differences in our series of gophers taken at the above-listed localities. In his description of *C. oreocetes* from 11,000 feet on Mount Popocatepetl, Merriam (1895b) apparently had only one specimen available, a "young adult" female, which misled him as to the true characters of the population at timber line. Our two specimens are fully adult and inseparable from adult males, which are definitely referable to *merriami*,

TABLE 2.—*Average and extreme measurements (in millimeters) of populations of Thomomys umbrinus*

LOCALITY	SEX	TOTAL LENGTH	LENGTH OF TAIL	LENGTH OF HIND FOOT	OCCIPITO-NASAL LENGTH	ZYGOMATIC BREADTH	MASTOID BREADTH	LENGTH OF NASALS	ALVEOLAR LENGTH OF MAXILLARY TOOTH ROW	NO. AVE.
Mt. Popocatepetl	♂	220 (202–240)	68 (60–78)	28.5 (28–29)	40.3 (39.0–41.4)	27.0 (25.9–27.6)	21.0 (20.6–21.3)	14.1 (13.5–15.0)	8.3 (8.1–8.5)	6
15 km NW San Martín	♂	225 (215–237)	68 (60–75)	29 (27–30)	39.9 (38.5–41.3)	27.9 (26.4–28.7)	21.0 (20.4–21.7)	14.8 (14.0–15.2)	7.9 (7.3–8.4)	4
Mt. Popocatepetl	♀	210 (201–218)	65 (59–68)	28.5 (28–29)	38.4 (37.0–39.2)	24.8 (23.5–25.9)	19.7 (18.0–20.3)	13.3 (12.5–14.3)	7.9 (7.7–8.2)	6
15 km NW San Martín	♀	205 (192–219)	58 (53–65)	26 (25–28)	36.5 (35.0–37.3)	23.5 (22.8–24.3)	19.2 (18.2–19.9)	12.4 (11.7–13.0)	7.5 (7.4–7.7)	3

taken at Monte Río Frío, in the pass north of Mount Ixtaccihuatl. A young female, which had not fully acquired adult pelage, from that locality agrees in all details, except color, with the description of *oreocetes*. Because *oreocetes* has no validity as judged by our specimens, it becomes necessary to reduce that name to the synonymy of the subspecies *merriami*. Furthermore, our series from Monte Río Frío is from the north slope of Mount Ixtaccihuatl and since no barrier to pocket gophers exists between Mount Popocatepetl and Mount Ixtaccihuatl (we found numerous sign of gophers in the pass at 12,000 feet between the two peaks, but did not collect specimens), it seems likely that all *Cratogeomys* in the area under consideration are referable to *C. m. merriami*. The race *C. m. peregrinus*, described from Mount Ixtaccihuatl, is also based upon a single specimen, which, as judged from Merriam's measurements, is not fully adult.

These large gophers, some individuals of which weighed more than 900 grams, were abundant at each of the localities listed above, but, because of their large size and the huge burrows they inhabited, were difficult to trap. Most of our specimens were collected with a shotgun when the gophers were foraging above ground.

Dichromatism is pronounced in the series from Monte Río Frío. With two exceptions, all the males are metallic greenish-black, as are about half of the females. The others are vary-

ing shades of brownish buff. Young-of-the-year were about half-grown in late June and early July. None of them had fully acquired adult pelage. A representative young one of this age measures 330–90–43; weight, 350 grams.

Cratogeomys irolonis Nelson and Goldman.—Irolo Pocket Gopher

Specimens examined: México: 5 km NW Texcoco, 7,600 ft., 8. *Hidalgo:* 85 km N Mexico City (9 km S Pachuca), 8,200 ft., 2.

When Merriam (1895) revised the pocket gophers (exclusive of the genus *Thomomys*), he had available three females of *Cratogeomys* from Irolo, Hidalgo, which he referred tentatively to the species *C. merriami*. Nelson and Goldman (1934b) segregated these specimens under the name *Cratogeomys merriami irolonis*. A critical study of our larger series, eight of which are from within 20 miles of the type locality, leaves me with no alternative to raising *irolonis* to specific rank. In fact, the differences between *irolonis* and *merriami* are, to my eye, greater than those separating many of the currently recognized species of *Geomys* or *Cratogeomys*. Tabulated below are some of the distinguishing features:

merriami	*irolonis*
width of upper incisor, 5 mm	width of upper incisor, 4 mm
interpterygoid spine minute	interpterygoid spine conspicuously enlarged
dihedral angle of maxillary plate 170–180°	dihedral angle of maxillary plate less than 160°
audital bulla with distinct swelling just below glenoid fossa	No swelling
foramen magnum higher than wide	foramen magnum wider than high
basioccipital nearly parallel-sided	basioccipital distinctly wedge-shaped
length of crown of M^3 less than crown length of Pm^4	length of crown of M^3 equal to crown length of Pm^4
coronoid process large, rounded on tip	coronoid process small, distinctly pointed
depression between root capsule of lower incisor and condyle of ramus shallow	depression between root capsule of lower incisor and condyle of ramus as deep as depression laterad to root capsule
claws large, robust	claws about one-half as large
hind foot 46 mm	hind foot 42 mm

The characters listed above separate individually and in combination each of the ten specimens of *irolonis* from all *merriami* at hand.

These gophers were common at the two localities listed above. One of the females, taken August 19, contained two large embryos. Half-grown young also were taken in August. All our specimens are females; the male of this species is as yet unknown.

Cratogeomys perotensis perotensis Merriam.—Perote Pocket Gopher

Specimens examined: Veracruz: N slope Cofre de Perote, 10,500 ft., 6.

In the cultivated fields, mostly potatoes and corn, near the small settlements of Conejo and Pescados on the north slope of the Cofre de Perote, these large, dark-colored pocket gophers were common and troublesome to the farmers. Our medium-sized Macabee gopher traps were too small to catch them with any degree of success.

The 13 specimens on which Merriam (1895) based his description are all females; the male of this form has long remained unknown. Fortunately, our series contains two adult males. In neither does the squamosal completely overlap the parietal as Merriam (*op. cit.*) predicted, but that it might do so with extreme age is suggested by the skull of an old female in which the parietal is not discernible.

Measurements of the older male follow: Total length, 322; length of tail, 76; length of hind foot, 40. Basilar length of Hensel, 52.0; zygomatic breadth, 41.0; mastoid breadth, 38.7;

interorbital breadth, 8.0; palatofrontal depth, 22.7; length of nasals, 23.0; breadth of rostrum, 15.0; alveolar length of maxillary tooth row, 11.4. No great sexual disparity in size is evident in our series, nor does the male differ appreciably in color from the female.

At the time of our visit to the Cofre de Perote (late July and early August) young of the year were about half-grown. None of the females was pregnant, suggesting a single litter born in May or June.

Cratogeomys perotensis estor Merriam.—Perote Pocket Gopher

Specimens examined: Veracruz: 5 km E Las Vigas, 8,000 ft., 3.

Contrary to Merriam's statement (1895) that *estor* and *perotensis* are indistinguishable as to color, our three specimens are distinctly rufous-tinted and readily separable from the darker *perotensis*. Although smaller than *perotensis* in external measurements, *estor* is just as big or bigger in mass. Our heaviest specimen of *perotensis*, an old female, weighed 524 grams (a fully adult male weighed 522 grams); our heaviest *estor*, which is 46 mm shorter in length of head and body than the largest male of *perotensis*, weighed 531 grams. This chunkiness of *estor* is reflected in their larger burrows, in which our traps were practically useless.

This gopher is common in the corn fields where it does considerable damage. A young female, taken August 7, was about half-grown; a young male taken at the same time was about 60 percent the mass of an adult male.

Cratogeomys fulvescens subluteus Nelson and Goldman.—Yellow Pocket Gopher

Specimens examined: Veracruz: Guadalupe Victoria, 8,300 ft., 5.

This large, fulvous-colored pocket gopher was common in the wheat fields at this station, where it associated with the Perote ground squirrel and Perote kangaroo rat. Dug in loose, friable soil, their burrows were large, nearly five inches in diameter, and our traps were not effective in catching them.

A young female, taken July 30, was about half-grown; none of the adult females taken at that time of year was pregnant. These data suggest a single litter of young each year.

I have nothing to add to Nelson and Goldman's description (1934), based upon two specimens from Perote, a short distance east of Guadalupe Victoria, other than that the sexual disparity in external measurements is not so great as their data might lead one to think.

Heterogeomys hispidus hispidus (Le Conte).—Hispid Pocket Gopher

Specimens examined: Veracruz: 5 km N Jalapa, 4,500 ft., 7.

These large, hispid gophers were common in the clearings and corn fields near Jalapa, where they did considerable damage to growing crops. Our traps were not effective in catching them; most of our specimens were caught by the local Mexicans who used snares or waited patiently at the opening of a fresh burrow to impale the animal with a pointed stick.

With the exception of a single specimen, which has a white band encircling the body in the lumbar region, our specimens are blackish brown, varying to nearly black. We were informed that a small percentage of the gophers at this locality are pure white.

Heterogeomys hispidus torridus Merriam.—Hispid Pocket Gopher

Specimens examined: Veracruz: 4 km S Vera Cruz, 30 ft., 5; Boca del Río, 10 ft., 5.

In the sand dunes near the city of Vera Cruz, this gopher was abundant and, where it conflicted with man as in fields, gardens and the cemetery at Vera Cruz, destructive.

Assuming that our specimens are typical of *torridus*, since they come from within 22 kilometers of the type locality, I question the treating of *torridus* as a subspecies of *hispidus*, to which it was reduced by Nelson and Goldman (1929). For one thing, *torridus* is a sparsely-haired animal, becoming almost naked at the time of molt, *hispidus* is heavily haired; *torridus* is slender, seldom weighing as much as 550 grams in a fully adult animal, whereas *hispidus* is robust, seldom weighing less than 700 grams when adult, often more than 800 grams; *torridus* has a shorter, broader skull and shorter, broader rostrum, with nasals much less ex-

panded distally; also, there are marked differences in the shape of the maxillary plate and zygoma. I find it possible to separate every specimen by each of the above mentioned differences.

Most of our specimens (July-taken) are in some stage of molt; some are nearly devoid of hair, others have definite molt lines on the head or back, the incoming pelage being darker (seal brown). The juvenal pelage is soft, woolly, and a lighter shade of brown.

One young (July 7) is about one month old; another (July 7) is about two-thirds grown and had produced a litter of young; one old female (July 19) was lactating, and another (July 22) contained two large embryos. These data suggest an extended breeding season and that females may breed in their first year.

Orthogeomys grandis alleni Nelson and Goldman.—Allen Pocket Gopher

Specimen examined: Guerrero: Río Aguacatillo, 30 km N Acapulco, 1,000 ft., 1 (alcoholic).

These large, sparsely-haired pocket gophers were common at this locality, but our traps were too small to be effective in catching them. Our specimen, an adult female, is considerably smaller than *alleni*, as judged by measurements recorded by Nelson and Goldman (1930), but, until additional material is available, it is tentatively referred to that race.

Measurements: Total length, 326; length of tail, 104; length of hind foot, 47; basilar length of Hensel, 54.3; zygomatic breadth, 37.8; mastoid breadth, 35; length of nasals, 22.8; breadth of rostrum, 16; interorbital breadth, 14.2; alveolar length of maxillary tooth row, 15.2.

Liomys irroratus torridus Merriam.—Spiny Pocket Mouse

Specimens examined: Guerrero: 15 km S Chilpancingo, 4,300 ft., 4.

These mice were abundant on the grass-covered hillsides at this locality. Their dens were usually under large boulders or in piles of rocks where they lived in association with *Baiomys* and *Peromyscus*. None of our specimens, taken in mid-August, was sexually active. The three males appear to be nearly full-grown young-of-the-year.

Liomys irroratus alleni (Coues).—Spiny Pocket Mouse

Specimens examined: Nuevo Leon: Río Ramos, 20 km NW Montemorelos, 1,000 ft., 1. *México:* 23 km E Mexico City, 7,500 ft., 20.

Specimens from the Valley of Mexico appear to be typical of *alleni*. Spiny pocket mice were exceedingly numerous at the station east of Mexico City, where they lived in stone fences and among the rocks on the sides of an old volcanic crater. They were caught in the same trap line with *Baiomys taylori* and *Peromyscus difficilis*, suggesting that these species lived there in close association.

The specimen from the Río Ramos locality, taken June 21, is in juvenal pelage. Young-of-the-year taken in early August were almost full-grown and scarcely distinguishable from adults. At that time of year none of the females was lactating or pregnant, suggesting that a single litter is reared.

Although Goldman (1911) does not mention a sexual disparity in size in this species, our series clearly indicates that adult males are consistently larger than adult females, outweighing them by almost 50 percent (females 44.2 grams; males, 64 grams).

Liomys guerrerensis Goldman.—Guerrero Spiny Pocket Mouse

Specimens examined: Guerrero: 15 km SW Chilpancingo, 9,000 ft., 2.

This large, robust, blackish *Liomys* was common on top of the mountains southwest of Chilpancingo. There it inhabited rocky situations in the cloud forest and was taken in the same trap line with the huge *Peromyscus thomasi*.

Goldman based his description of this species on two immature specimens; the adults have long remained unknown. Fortunately, one of our specimens is an old female; the other is nearly full-grown. The older one (taken August 17) contained embryos and the condition of her nipples indicate that she had had a previous litter that year.

Measurements: Total length, 285, 290; length of tail, 131, 135; length of hind foot, 34, 32; greatest length of skull, 35.2, 35.8; zygomatic breadth, 17.4, 17.9; interorbital breadth, 8.8, 8.5; length of nasals, 13.7, 13.7; width of braincase, 16.1, 16.8; alveolar length of upper molariform series, 6.3, 6.1; weight, 85, 89.2 grams.

Liomys pictus obscurus Merriam.—Tropical Spiny Pocket Mouse

Specimens examined: Veracruz: Boca del Río, 10 ft., 3; Plan del Río, 1,000 ft., 1; Puente Nacional, 500 ft., 1.

These mice were not common at these localities; persistent trapping yielded few specimens. Those from Boca del Río were taken in sand hills near the Gulf that were profusely covered with vegetation; the one from Plan del Río was taken on a dry, rocky hillside overgrown with xerophytic vegetation, while the one from Puente Nacional, an immature in juvenal pelage, was taken in tall grass near a spring.

One taken July 6 was in juvenal pelage; another (July 23) has acquired adult pelage except on the belly, sides, and hips. Males taken in late July had enormous testes, suggesting active breeding, but the adult female contained no embryos.

Liomys pictus rostratus Merriam.—Tropical Spiny Pocket Mouse

Specimens examined: Guerrero: Río Aguacatillo, 30 km N Acapulco, 1,000 ft., 6.

This mouse was relatively abundant in the dense brush on the hillsides near the river. Most of our specimens are nearly full-grown young. The testes of an adult male taken in mid-August were enormously enlarged and probably in breeding condition.

These specimens differ conspicuously from *pictus* taken in Veracruz in having extremely short hairs on the upper surface of the tail, leaving the annulations fully exposed. I have seen no previous mention of this difference in the literature.

Perognathus flavus mexicanus Merriam.—Pygmy Pocket Mouse

Specimens examined: Hidalgo: 85-97 km N Mexico City (near Pachuca), 8,200 ft., 2. *México:* 22 km E Mexico City, 7,600 ft., 1. *Puebla:* 10 km W San Andrés, 8,000 ft., 1; Laguna Salada (near Alchichica), 8,000 ft., 1.

These tiny pocket mice were far more abundant on the Mexican tablelands than our records indicate. Because of their small size, only on occasion was one caught in a Museum Special trap. Larger series could have been taken by catching them by hand at night with the aid of flashlights.

Our records for eastern Puebla extend the known range of this mouse considerably to the east. We saw mice of this species near Perote in Veracruz, but were unable to catch them in the tall vegetation.

Perognathus hispidus zacatecae Osgood.—Hispid Pocket Mouse

Specimens examined: Hidalgo: 85 km N Mexico City (9 km S Pachuca), 8,200 ft., 7.

Among the cultivated maguey plants at this station, hispid pocket mice were fairly common. There they associated with the abundant *Peromyscus maniculatus*, both kinds being taken in the same trap lines. Numbers of burrows of *zacatecae* were found in the ditch banks; many were at the bases of the large magueys.

These specimens extend the known range of *zacatecae* nearly 150 miles to the south and east, previous records being from the states of Guanajuato and Zacatecas.

Three of our specimens, taken August 21-23, were about half-grown and in juvenal pelage. The testes of adult males at that time were large; none of the adult females was pregnant or suckling young.

Dipodomys phillipsii phillipsii Gray.—Mexican Kangaroo Rat

Specimens examined: México: 17 km ESE Mexico City, 7,600 ft., 1. *Hidalgo:* 85 km N Mexico City (9 km S Pachuca), 8,200 ft., 1.

Kangaroo rats were common, in the Valley of Mexico and on the arid plateau south of Pachuca, but they did not readily enter our traps. We saw several of them crossing the highway at night. The specimen from near Pachuca is a nearly full-grown young-of-the-year.

Measurements: (Adult male from 17 km ESE Mexico City.) Total length, 283; length of tail, 178; length of hind foot, 40; weight, 50.7 grams.

Dipodomys phillipsii perotensis Merriam.—Mexican Kangaroo Rat

Specimens examined: Veracruz: Guadalupe Victoria, 8,300 ft., 5. *Puebla:* Laguna Salada (near Alchichica), 8,000 ft., 2; 10 km W San Andrés (Chalchicomula), 8,300 ft., 1.

In the original description of *perotensis*, Merriam (1894) considered the kangaroo rat from the semidesert area of Veracruz as specifically distinct, pointing out that externally it is similar to *phillipsii* from the Valley of Mexico, but differing in slightly paler coloration, zygomata visible from above, cranium more highly vaulted, supraoccipital wider between the inflated mastoids, and angle of mandible larger.

Not all of these characters hold in our specimens. The width of the supraoccipital is variable; in some specimens exceeding *phillipsii*, in others it is narrower. In one of the two specimens of *phillipsii* the zygomata are not completely hidden by the supraoccipital shelf; in the other the cranium is as highly arched as in *perotensis*. The only characters I can find to separate *phillipsii* from *perotensis* are (1) relatively narrower zygomatic breadth, (2) narrower basioccipital, (3) lesser extension of premaxilla posterior to nasals. The difference in the angle of the mandible is not evident in our specimens, nor is there a color difference. For these reasons it seems advisable to consider *perotensis* and *phillipsii* conspecific, but separable as geographic races.

Kangaroo rats were abundant in the sandy areas near Perote, Guadalupe Victoria, El Limón, Alchichica, and in the valley west of Mount Orizaba, but they proved to be difficult to trap or to catch by hand at night with the aid of flash lights. When molested at night, they immediately sought refuge in their burrows.

By the first week of August young-of-the-year were about two-thirds the weight of adults, which averaged 56.5 grams. None of the adult females taken at that time was pregnant or lactating, suggesting that a single litter of young is reared each year.

Reithrodontomys megalotis saturatus Allen and Chapman.—Big-eared Harvest Mouse

Specimens examined: Veracruz: 5 km E Las Vigas, 8,000 ft., 2; Guadalupe Victoria, 8,300 ft., 1; N slope Cofre de Perote, 10,500 ft., 3. *Puebla:* Laguna Salada (near Alchichica), 8,000 ft., 6; Río Otlati, 15 km NW San Martín, 8,700 ft., 20. *Tlaxcala:* 8–13 km SW Tlaxcala, 7,500 ft., 3. *México:* 5 km NW Texcoco, 7,600 ft., 2; Monte Río Frío, 45–55 km ESE Mexico City, 10,500 ft., 11.; Lago Zempoala, 45 km SW Mexico City, 9,400 ft., 3. *Hidalgo:* 97 km N Mexico City (9 km SW Pachuca), 8,400 ft., 1.

Merriam (1901a) described *Reithrodontomys saturatus cinereus* on the basis of five specimens from the semidesert area near Chalchicomula (San Andrés), Puebla, stating that *cinereus* is "similar to *saturatus* but very much paler and grayer, particularly the head and shoulders; tail shorter and more sharply bicolor". Howell (1914) transferred both *saturatus* and *cinereus* to the species *megalotis* and assigned to *cinereus* six additional specimens from widely scattered localities on the Mexican plateau, remarking that it is "intermediate between *saturatus* and *megalotis*".

I have examined 52 specimens of *megalotis* from the states of Veracruz, Puebla, Tlaxcala, México, and Hidalgo. Specimens from Las Vigas (type locality) and the Cofre de Perote are dark and typical of *saturatus*, as are those from Guadalupe Victoria and the mountains southwest of Mexico City. The two from Texcoco agree with *cinereus*. The remaining 40 specimens present an intermingling of characters assigned to *cinereus* and *saturatus*. In color 2 of the 6 specimens from the Laguna Salada agree with *saturatus*, 4 with *cinereus*; 2 specimens from Tlaxcala agree with *saturatus*, 1 with *cinereus*; 15 from the Río Otlati agree with *saturatus*, 5 with *cinereus*; 10 from the Monte Río Frío agree with *saturatus*, 1 with *cinereus*.

Considering only adult or near adult animals (weight more than 11 grams), the length of

tail in our series is as follows: Las Vigas, 96; Cofre de Perote, 78; Laguna Salada, 84 (72–92); Tlaxcala, 83 (82–85); Río Otlati, 83 (75–92); Monte Río Frío, 83 (76–90); near Pachuca, 91; Lago Zempoala, 80 (72–85); Texcoco, 94 (89–99). Howell (*op. cit.*, p. 36) gives the average and extremes of tail length of *cinereus* as 74 (71–78); of *saturatus*, 87 (80–95). Consequently, on the basis of tail length alone, all our specimens are referable to *saturatus*, with the exception of the one specimen from the Cofre de Perote.

No cranial characters have been found to differentiate *cinereus* from *saturatus*. The only remaining difference is in color, which, as I have pointed out, is unstable in populations taken from the same habitat at a single locality. Because color alone is a poor criterion by which to differentiate most races of mammals, particularly rodents, it seems advisable to refer all *megalotis* from the highlands of east-central Mexico to the race *saturatus* and to consider *cinereus* a synonym of *saturatus*.

Of the three species of harvest mice (*R. megalotis*, *R. fulvescens*, and *R. chrysopsis*) occurring in central Mexico, *R. megalotis* is most abundant and widespread, occurring in grassy areas at elevations between 6,000 and 11,000 feet. It commonly is taken in associations with *Microtus mexicanus*, *Peromyscus melanotis*, and *Neotomodon alstoni*.

The breeding season of *megalotis* in this region is long and doubtless each female gives birth to two or more litters a year. Nearly full-grown young, weighing 8–10 grams, were taken the first week of July; on July 22 a lactating female and one with small embryos were taken; on August 15 a female with three nearly full term embryos was caught, and on August 21 one containing three mid-term embryos. A gravid female with three large embryos weighed 20 grams, suggesting that the young at birth weigh slightly more than two grams each (nonpregnant females weighed approximately 14 grams).

Reithrodontomys fulvescens tenuis Allen.—Fulvous Harvest Mouse

Specimen examined: Nuevo Leon: Río Ramos, 20 km NW Montemorelos, 1,000 ft., 1.

Our data (only one specimen was caught in more than 500 trap-nights) suggest that harvest mice were not of common occurrence at this station. This specimen was taken in the upland-brush community.

Reithrodontomys fulvescens difficilis Merriam.—Fulvous Harvest Mouse

Specimen examined: Tlaxcala: 8 km SW Tlaxcala, 7,500 ft., 1.

This specimen appears to be referable to *difficilis* and extends the known range of the subspecies considerably westward. This locality, with that of *toltecus* from Río Otlati, nearly unites the ranges of *difficilis* and *toltecus*. This specimen was trapped in the ruins of a stone building.

Reithrodontomys fulvescens toltecus Merriam.—Fulvous Harvest Mouse

Specimens examined: México: 17–22 km E Mexico City, 7,500 ft., 2. *Puebla:* Río Otlati, 15 km NW San Martín, 8,700 ft., 1.

These specimens appear to be intergrades between *toltecus* and *difficilis*. In length of tail, two are referable to *difficilis*; in color and in length of skull they are closest to *toltecus*. They were trapped in relatively barren areas; one was apparently living in a stone wall.

Reithrodontomys fulvescens mustelinus Howell.—Fulvous Harvest Mouse

Specimens examined: Guerrero: 15 km S Chilpancingo, 4,300 ft., 5.

These specimens appear to be intergrades between *mustelinus* and *R. f. helvolus*. Three individuals have the underparts tinged with buff, in two the belly is white; in three the palatine foramina extend posteriorly past the plane of the molars. They are here referred tentatively to *mustelinus* on the basis of longer nasals. They show no approach to *toltecus*, the skulls being considerably smaller.

Harvest mice were numerous in the grassy, rolling hills south of Chilpancingo, being outnumbered only by the diminutive *Baiomys*.

Reithrodontomys fulvescens tropicalis subsp. nov.—Fulvous Harvest Mouse

Type.—Male, adult, skin and skull, no. 3084, Texas Cooperative Wildlife Collection; Boca del Río (8 km south of Vera Cruz), elevation 10 feet, Veracruz; collected July 22, 1942, by David M. Donaldson, original number, 72.

Distribution.—Coastal area of central Veracruz, inland at least to Plan del Río.

Diagnosis.—A small, short-bodied, long-tailed, cinnamon-colored harvest mouse, resembling *R. f. tenuis*, but smaller and differing in color and cranial characters. Outer wall of anteorbital foramen wider than interpterygoid space; maxillary tooth row averaging 3.1 mm; palatine foramina short, terminating anterior to plane of molars; molars without accessory loop; under parts and feet whitish.

Comparisons.—Compared with *tenuis:* Smaller in all respects—hind foot 17, rather than 20; tail 88, rather than 98; palatine foramina terminating anterior to, rather than posterior to, plane of molars. Much smaller than *difficilis*.

Remarks.—The assignment by Howell (1914) to *tenuis* of a range encompassing tropical as well as montane habitats seems hardly tenable on ecologic grounds. This, coupled with the marked differences observed in the specimens from central Veracruz, when compared with *tenuis* and *difficilis*, seemingly justify the recognition of a lowland coastal race.

Measurements (average and extremes of two males and one female). Total length, 158 (153–166); length of tail, 88 (87–88); length of hind foot, 17 (16–18); occipitonasal length 21.0 (20.7–21.2); length of maxillary tooth row, 3.1 (3.1–3.2); cranial breadth, 10.0 (9.6–10.3); least interorbital constriction, 3.5 (3.4–3.5).

TABLE 3.—*Measurements of Reithrodontomys chrysopsis perotensis*

SEX	EXTERNAL	OCCIPITO-NASAL LENGTH	BREADTH OF BRAIN CASE	LENGTH OF NASALS	LENGTH OF MAXILLARY TOOTH ROW
*♀	184–108–21–17	23.7	11.3	9.3	3.5
*♂	181–107–22–17	24.0	11.5	9.5	3.5
♀	176–92–20–16	—	—	—	—
♂	176–104–21–17	23.5	11.4	9.3	3.5

* From Mount Orizaba; the other two are from Cofre de Perote.

Specimens examined.—Four from Veracruz as follows: Boca del Río, 3; Plan del Río, 1,000 ft., 1 (skin only).

Reithrodontomys chrysopsis chrysopsis Merriam.—Volcano Harvest Mouse

Specimens examined: México: Monte Río Frío, 55 km ESE Mexico City, 10,500 ft., 1; N slope Mt. Popocatepetl, 13,500 ft., 2. *Puebla:* Río Otlati, 15 km NW San Martín, 8,700 ft., 1.

In more than 2,000 trap-nights only four specimens of this mouse were taken—all in "sacaton" grass among conifers and in association with *Neotomodon alstoni*. Seemingly this mouse is nowhere abundant. One of the two from timber line on Mt. Popocatepetl, taken July 22, is about two-thirds grown; neither of the adult females, July-taken, was pregnant.

Reithrodontomys chrysopsis perotensis Merriam.—Volcano Harvest Mouse

Specimen examined: Veracruz: N slope Cofre de Perote, 10,500 ft., 2. *Puebla:* W slope Mt. Orizaba, 16 km NE San Andrés, (Chalchicomula), 11,000 ft., 2.

In 1893, E. W. Nelson and E. A. Goldman collected two harvest mice from the high mountains of eastern México, one from an elevation of 9,500 feet on Cofre de Perote, the other from 9,500 feet on Mount Orizaba. These two mice constituted the basis for Merriam's descriptions (1901a) of *Reithrodontomys perotensis* and *R. orizabae*. Later, Howell (1914) considered *orizabae* conspecific with *R. chrysopsis*, but retained *perotensis* as a full species in the *chrysopsis* group.

From the time Nelson and Goldman first collected these mice in 1893, no additional specimens, except for the two males and two females procured by our field parties in the summer of 1942, have appeared in American collections. Study of these four specimens, two from 10,500 feet on Cofre de Perote, and two from 11,000 feet on Mount Orizaba, reveals that the characters ascribed to *perotensis* by both Merriam and Howell do not apply to the material at hand. In fact, I am unable to separate *perotensis* from *orizabae* on the basis of any character or combination of characters. (For measurements, see Table 3.) Because of this, it seems necessary to consider these two "forms" identical. It should be pointed out that no ecological or physical barrier is interposed between Cofre de Perote and Mount Orizaba.

As pointed out above, Howell (*op. cit.*), in his revision of the genus *Reithrodontomys*, referred *orizabae* to the species *chrysopsis*. Comparison of our material with topotypes of *chrysopsis* substantiates his arrangement. But since *orizabae* and *perotensis* are not separable, it becomes necessary to refer all mice of the *chrysopsis* group from the Cofre de Perote-Mount Orizaba region to the species *Reithrodontomys chrysopsis*. This arrangement necessitates utilization of the name *R. c. perotensis* for these mice, because of priority, and the relegation of *R. c. orizabae* to the synonymy of *perotensis*.

At neither of these stations were harvest mice numerous. Our specimens were taken in snap traps set in sacaton grass primarily for *Neotomodon*, which were abundant.

Baiomys taylori analogus (Osgood).—Pygmy Mouse

Specimens examined: México: 17-23 km E Mexico City, 7,500 ft., 20.

These diminutive mice were abundant in rocky situations at the foot of an old volcanic crater, sharing the area with *Liomys irroratus* and *Peromyscus difficilis*. Most of our specimens were taken in snap traps set along a crumbling stone wall. Ground vegetation was sparse.

In late July and early August, young-of-the-year were about three-fourths grown; none of the females was pregnant.

Baiomys musculus musculus (Merriam).—Tropical Pygmy Mouse

Specimens examined: Veracruz: Boca del Río, 10 ft., 1; Plan del Río, 1,000 ft., 2; Puente Nacional, 500 ft., 1. *Guerrero:* Río Aguacatillo, 30 km N Acapulco, 1,000 ft., 3; 15 km S Chilpancingo, 4,300 ft., 10.

At the Veracruzan localities these mice were taken in dense ground vegetation, largely grasses. There they apparently lived in underground burrows. Near Chilpancingo they were abundant in rocky situations, living among and under rocks and sharing the area with *Liomys* and *Peromyscus*. Seemingly the species has a wide tolerance to habitat conditions.

A female taken July 23 at Boca del Río contained three embryos whose combined weight was 4.3 grams—more than one-third the weight of the mother. A few days later at Plan del Río a nearly full-grown male was captured.

Although assigned a wide range in México (Osgood, 1909), it appears that adequate material will reveal geographic variation in the mice currently assigned to *musculus*. Specimens from near Chilpancingo, for example, are lighter in weight than those from near Acapulco (10.8 grams as opposed to 14.2 grams), although external measurements are comparable.

Peromyscus maniculatus fulvus Osgood.—Deermouse

Specimens examined: Veracruz: Guadalupe Victoria, 8,300 ft., 10. *Puebla:* Laguna Salada (near Alchichica), 8,000 ft., 9; 12 km NNE San Andrés, W slope Mt. Orizaba, 10,000 ft., 8. *Tlaxcala:* 8 km SW Tlaxcala, 7,500 ft., 6. *México:* 5 km NW Texcoco, 7,600 ft., 8; 23 km E Mexico City, 7,500 ft., 10. *Hidalgo:* 85 km N Mexico City (9 km S Pachuca), 8,200 ft., 10, 97 km N Mexico City (9 km SW Pachuca), 8,400 ft., 2.

In the desert areas of the eastern part of the Mexican tableland, deermice were abundant, outnumbering any other species of rodent in the area as judged by out trapping records. Preference was shown for fields of maguey where the soil was not excessively rocky. Rocky areas were occupied by other species of *Peromyscus*.

In our series of more than 60 specimens, those from Guadalupe Victoria, Laguna Salada, and the base of Mt. Orizaba are noticeably paler than mice from the states of Tlaxcala, México, and Hidalgo, suggesting that the latter area is one if intergradation between *fulvus*, to the east and south, and *labecula*, the race in western and central Mexico.

At the base of Mt. Orizaba, 10,000 feet elevation, *fulvus* and *Peromyscus melanotis* occurred together. That hybridization of these two species takes place there is suggested by two females, both containing embryos 10 mm in rump-crown length. Both have short, light-colored pelage, long tails (72–82), and short ears, characters of *fulvus*, but the skulls are large and broad as in *melanotis*.

Seemingly the breeding season of *fulvus* is long. Nearly full-grown young-of-the-year were taken in July and in the same month, and also in August, females containing from 4 to 5 embryos in various stages of development were trapped. Our latest pregnancy record is August 21.

Peromyscus maniculatus labecula Elliot.—Deermouse

Specimens examined: Puebla: Río Otlati, 15 km NW San Martín, 8,700 ft., 6. *México:* Monte Río Frío, 55 km ESE Mexico City, 10,500 ft., 1. *Morelos:* Huitzilac, 9,050 ft., 5.

Our experience with this mouse is restricted to the forested, mountainous areas of central Mexico, where it occurs in company with the darker, larger-eared *Peromyscus melanotis*. At lower elevations in the mountains *labecula* is more abundant; at higher elevations *melanotis* far outnumbers it. For example, at the Monte Rio Frío station at 10,500 feet, only one *labecula* and more than 60 *melanotis* entered our traps. No indication of hybridizition of the two is evident in our specimens.

Females taken July 21, 23, and August 12 contained from 2 to 4 embryos. Young-of-the-year in various stages of development also were caught, but not preserved.

Peromyscus melanotis Allen and Chapman.—Black-eared Woodland Mouse

Specimens examined: Veracruz: N slope Cofre de Perote, 10,500 ft., 10. *Puebla:* 12–16 km NNE San Andrés, W slope Mt. Orizaba, 10,000–11,00 ft., 20. *México:* N slope Mt. Popocatepetl, 13,500 ft., 10; Monte Río Frío, 45 km ESE Mexico City, 10,500 ft., 24.; Lago Zempoala, 45 km SW Mexico City, 9,400 ft., 9.

This mouse is characteristic of the forested mountains of central México, ranging from about 9,000 feet up to at least 13,500 feet. Although showing a decided preference for habitats dominated by sacaton grass in the understory, it also was trapped in marshy situations (Lago Zempoala) and on rocky outcrops. It associated with *Neotomodon alstoni* at the above-listed stations, both species being taken in the same trap lines. It is by far the most abundant rodent in its range.

Unlike some of the other small rodents occurring at these stations, *P. melanotis* exhibits but slight geographic variation. Specimens from the Cofre de Perote-Orizaba region average slightly larger than those from the high mountains near Mexico City, but the ranges of individual variation are almost identical.

Records indicate that this mouse has a long breeding season and that several litters are reared each year. Young in dark, slate-colored pelage were taken from June 15 to August 25. Also, we have pregnancy records for June 25, 27; July 28; August 5, 10, 15. Our data suggest that the interval between peaks of pregnancy is approximately 45 days (June 25–August 10). The number of embryos averaged 3.7 (1–5).

Peromyscus leucopus texanus (Woodhouse).—White-footed Mouse

Specimens examined: Nuevo Leon: Río Ramos, 20 km NW Montemorelos, 1,000 ft., 7.

White-footed mice were not common at this locality, nor were other small rodents, as judged by our take of only 9 *texanus* in more than 500 trap nights. These mice are darker than specimens of *texanus* from southern Texas (La Salle and Aransas counties).

One female, taken July 14, contained three nearly full term embryos; young, nearly two-thirds grown and in juvenal pelage, were taken September 1.

Peromyscus leucopus mesomelas Osgood.—White-footed Mouse

Specimens examined: Veracruz: 5 km N Jalapa, 4,500 ft., 9.

The heavily vegetated, rocky banks of the Río Banderillo harbored numerous mice, both *mesomelas* and the larger *Peromyscus furvus* being abundant. I have been impressed with the consistency with which two species of *Peromyscus*, one large, the other smaller, have been found living in the same area in Mexico—at Rio Ramos (Nuevo Leon), *P. leucopus* and *P. pectoralis;* at Río Tasquillo (Hidalgo), *P. truei* and *P. difficilis;* near Mexico City, *P. maniculatus* and *P. difficilis;* near Chilpancingo (Guerrero), *P. megalops* and *P. thomasi.*

Although our specimens were identified as *mesomelas* by E. A. Goldman, who had available good comparative material, they differ from Osgood's description (1909, p. 132). Osgood states that *mesomelas* is similar to *texanus*, but darker and with a shorter tail. Actually, these specimens are much larger than any of the more than 70 *texanus* I have had available for comparison. The tail of typical *texanus* averages 81 mm, whereas the average length of tail in this series is 99 and in none is the length less than 90.

None of the females, taken July 1–4, was pregnant, nor did young of the year enter our traps.

Peromyscus boylii levipes Merriam.—Boyle White-footed Mouse

Specimens examined: Veracruz: 5 km E Las Vigas, 8,000 ft., 7; north slope Cofre de Perote, 10,500 ft., 1. *Puebla:* Río Otlati, 15 km NW San Martín, 8,700 ft., 4. *Guerrero:* 15 km S Chilpancingo, 4,300 ft., 6.

This short-eared, long-tailed mouse seemingly is adapted to several habitats. Specimens were trapped in tall sacaton grass, in mixed grasses and herbs along a creek, on rocky bluffs, and in a lava flow. It has a decided preference for rocky situations, however, where it frequently occurs with the larger *Peromyscus difficilis*. In grassy areas it associates with *Peromyscus melanotis*.

Although Osgood (1909, p. 154) states that "there is little local variation" in *boylii* in the range currently assigned to the race *levipes*, our specimens from Veracruz are consistently longer-tailed than those of similar age from the other localities. In fact, the tail is 20 percent longer than in specimens from Guerrero, and in topotypes (see Osgood, *op. cit.*), and 15 percent longer than in specimens from Puebla. This circumstance suggests that *beatae* Thomas, placed in the synonymy of *levipes* by Osgood (*op. cit.*), may be a valid race occupying the mountainous eastern rim of the Mexican highlands.

Our data suggest that at least two litters of 2–3 young are reared yearly; nearly full-grown young were trapped August 6–15 and two of six females (one a subadult of the year) taken then were pregnant.

Peromyscus truei gratus Merriam.—True White-footed Mouse

Specimens examined: Hidalgo: Río Tasquillo, 26 km E Zimapan, 5,000 ft., 10; 97 km N Mexico City (9 km SW Pachuca), 8,400 ft., 2.

This mouse is characteristic of rocky habitats in the arid regions of the Mexican Plateau, in many places associating with the much larger *Peromyscus difficilis*. Females taken July 11 either were pregnant or suckling young. The number of young averaged three. On the same date nearly full grown young were trapped.

Peromyscus difficilis amplus Osgood.—Big-eared Rock Mouse

Specimens examined: Puebla: Laguna Salada (near Alchichica), 8,000 ft., 12; Río Otlati, 15 km NW San Martín, 8,700 ft., 12. *Tlaxcala:* 13 km NE Tlaxcala, 7,800 ft., 6. *México:* 23 km E Mexico City, 7,500 ft., 10.

This species in our experience is restricted entirely to rocky situations. Canyon walls and volcanic craters afford ideal habitat, but stone buildings and fences in disrepair also are utilized. In such a habitat *difficilis* associates with other rock-frequenting rodents, such as *Peromyscus truei*, *Baiomys taylori*, and *Liomys irroratus*.

Females taken July 23 and August 15–16 contained embryos, averaging 2.5 per female. Numerous young mice also were trapped in July and August, suggesting that a female may rear three or more litters a year.

Peromyscus difficilis difficilis (Allen).—Big-eared Rock Mouse

Specimens examined: Hidalgo: Río Tasquillo, 26 km E Zimapan, 5,000 ft., 10.

This mouse was abundant in the rocky cliffs above the Río Tasquillo, where it lived in association with the smaller, big-eared *Peromyscus truei gratus*. Of the seven females captured, July 11–12, two contained three embryos each, 15 mm in rump-crown length. At the same time, several young nearly one-half grown were trapped.

Peromyscus difficilis felipensis Merriam.—Big-eared Rock Mouse

Specimens examined: México: Lago Zempoala, 45 km Sw Mexico City, 9,400 ft., 2.

These specimens were taken on a rocky hillside in the pine-fir community.

Peromyscus melanophrys melanophrys (Coues).—Gray-cheeked Rock Mouse

Specimens examined: Guerrero: 15 km S Chilpancingo, 4,500 ft., 5.

These mice were abundant in the rocky outcroppings in the pass south of Chilpancingo, where they were taken with *Peromyscus boylii*, *Baiomys musculus*, and *Liomys irroratus*. Four of the five specimens were parasitized by larvae of *Cuterebra* sp., two of them harboring one each; the others, two each. None of the other small rodents taken at this station was infested. None of the three females, taken August 21, was pregnant, but each had enlarged mammae.

Unfortunately, the skulls of these specimens were lost, so subspecific determination cannot be certain. The series averages smaller than *melanophrys* as recorded by Osgood (1909, p. 185), approaching in this respect *P. m. consobrinus* from Zacatecas and Jalisco. For geographic reasons I have referred them provisionally to the southern race.

Peromyscus furvus Allen and Chapman.—Jalapa Rock Mouse

Specimens examined: Veracruz: 5 km N Jalapa, 4,500 ft., 10.

These mice were living in the rocky canyon walls of the Río Banderillo, which also were occupied by the smaller *Peromyscus leucopus*. None of the females, taken July 2–4, was pregnant or lactating. Nearly full-grown young were captured, however.

Peromyscus mexicanus mexicanus (Saussure).—Mexican Long-tailed Mouse

Specimen examined: Veracruz: Puente Nacional, 500 ft., 1.

Rodents of all kinds were scarce at this station; more than 250 trap-nights yielded but three mice, one *Baiomys musculus*, one *Peromyscus mexicanus*, and one *Liomys pictus*. The *Peromyscus*, containing one small embryo, was captured July 7 in a trap set on a rocky canyon wall.

Peromyscus banderanus banderanus Allen.—Banderas Wood Mouse

Specimens examined: Guerrero: Río Aguacatillo, 30 km N Acapulco, 1,000 ft., 6.

The nearly impenetrable brushy hillsides at this station harbored numbers of these long-tailed mice. Apparently this species is restricted to such a habitat as none was taken elsewhere. One of the two females taken August 6 contained three nearly full term embryos. This female weighed 57.9 grams suggesting that the young at birth weigh about four grams each; non-pregnant females averaged 43 gram. Young in juvenal pelage and weighing nearly 75 percent as much as adults were captured on August 14.

Peromyscus megalops auritus Merriam.—Big Rock Mouse

Specimens examined: Guerrero: 15 km S Chilpancingo 9,000 ft., 9.

Among the large boulders in the cloud forest near the top of the mountains south and

slightly west of Chilpancingo, this mouse was abundant and readily entered our traps. There it lived in association with the huge *Peromyscus thomasi* and the giant of spiny pocket mice, *Liomys guerrerensis*. The breeding season of this species is extended as in other members of the genus. One of the females taken August 17 contained three embryos. No juveniles were captured, but nearly adult specimens with slightly worn teeth were.

Peromyscus thomasi Merriam.—Giant Rock Mouse

Specimens examined: Guerrero: 15 km S Chilpancingo, 9,000 ft., 2.

These huge mice—nearly as large as the common house rat—lived among the masses of boulders in the cloud forest near the top of the mountains south and slightly west of Chilpancingo. The small number of specimens captured is no measure of their abundance for the mice are so large that out Museum Special traps failed to hold most of those that entered them. Also, the smaller *P. megalops* were numerous and filled many of the traps. Both specimens of *thomasi* are males.

Neotomodon alstoni alstoni Merriam.—Volcano Mouse

Specimens examined: Puebla: Río Otlati, 15 km NW San Martín, 8,700 ft., 8. *México:* Lago Zempoala, 45 km Sw Mexico City, 9,400 ft., 7; N slope Mt. Popocatepetl, 13,500 ft., 9; Monte Río Frío, 45–55 km ESE Mexico City, 10,500 ft., 24.

The volcano mouse is characteristic of the high mountains of central México, occupying an altitudinal range from 8,700 feet to timberline (14,000 feet) where "sacaton" is the dominant grass. In habits, *Neotomodon* is essentially like *Peromyscus melanotis* and both of them occurred together at each of the above-listed localities.

The breeding season extends from at least June to September. Our data suggest that two or three litters of 2–5 young (average 3.3) are reared annually.

Neotomodon alstoni perotensis Merriam.—Volcano Mouse

Specimens examined: Puebla: W slope Mt. Orizaba, 11,000 ft., 9. *Veracruz:* N slope Cofre de Perote, 10,500 ft., 19.

Merriam (1898), in his report on these unique mice, considered the populations from the mountains near Mexico City, from the Cofre de Perote, and from Mount Orizaba as distinct species, naming them, respectively, *Neotomodon alstoni*, *N. perotensis*, and *N. orizabae*. Our specimens, as shown by Follansbee (MS), demonstrate that the three are conspecific and that *orizabae* is inseparable from *perotensis*. My independent study is in agreement with Follansbee's conclusions.

The habits and habitat of *perotensis* are similar to those of *alstoni*.

Oryzomys couesi mexicanus Allen.—Coues Rice Rat

Specimens examined: Guerrero: Río Aguacatillo, 30 km N Acapulco, 1,000 ft., 2.

These rats were trapped August 6 in dense herbaceous vegetation near the river. One is about two-thirds grown and still in juvenal pelage.

Oryzomys couesi crinitus Merriam.—Coues Rice Rat

Specimen examined: Tlaxcala: 8 km SW Tlaxacala, 7,500 ft., 1.

This specimen, a juvenile about two-thirds grown, has been referred provisionally to *crinitus* by E. A. Goldman on the basis of its large molars. It was trapped at the edge of a marsh in association with *Microtus mexicanus*.

Oryzomys couesi aquaticus Allen.—Coues Rice Rat

Specimen examined: Nuevo Leon: Río Ramos, 20 km NW Montemorelos, 1,000 ft., 1.

The presence of *aquaticus* at this locality constitutes a southward extension of its known range. This specimen, a half-grown juvenile, was trapped September 1 near a rock fence about 100 yards from the river.

Sigmodon hispidus berlandieri Baird.—Hispid Cotton Rat

Specimen examined: Hidalgo: 97 km N Mexico City (9 km SW Pachuca), 8,400 ft., 1.

Among the named races of *hispidus*, the specimen at hand is closest to *berlandieri* as known to me by specimens from southern Texas.

Sigmodon alticola amoles Bailey.—Mountain Cotton Rat

Specimens examined: México: Monte Río Frío, 45 km ESE Mexico City, 10,500 ft., 5.

These rats, presumably a family group consisting of a female and one-third grown young, were taken June 26 in a meadow in association with *Microtus mexicanus*. They were not numerous as diligent search failed to locate additional occupied areas.

E. A. Goldman compared these specimens with the series of *Sigmodon* in the Biological Surveys Collection and identified them as *amoles*. The presence of this race in the Monte Río Frío area extends the known range of *amoles* considerably southward from Pinal de Amoles, Queretaro, the type locality.

Neotoma torquata Ward.—Ward Wood Rat.

Specimens examined: México: Lago Zempoala, 45 km S Mexico City, 9,400 ft., 1; Monte Río Frío, 45–55 km ESE Mexico City, 10,500 ft., 6. *Puebla:* Río Otlati, 15 km NW San Martín 8,700 ft., 1; Laguna Salada (near Alchichica) 8,000 ft., 1; W slope Mt. Orizaba, 9,000–9,500 ft., 2. *Veracruz:* N slope Cofre de Perote, 10,500 ft., 1; 5 km E Las Vigas, 8,000 ft., 1.

Wood rats were more numerous at these localities than out records indicate. We found them difficult to trap—they refused all baits offered. Those taken were caught in unbaited steel traps concealed in their runways. These rats have a decided preference for rocky situations, their bulky nests being placed in the crannies and crevices.

The specimens from the Cofre de Perote-Orizaba region differ from those from the mountains near the Valley of Mexico in smaller size, shorter tooth row, shorter nasals, and in other minor details and appear to be worthy of subspecific status under the name *N. t. orizabae* Merriam. Additional material is needed from this area, however, to determine their relationships with certainty.

Breeding data suggest two or more litters a year. Pregnancy records are for June 28, July 2, August 2 and 12; a female taken July 21 was nursing a litter. A young one taken July 28 was nearly two-thirds grown; another, August 5, was about one-third grown and in the "blue" juvenal pelage.

Measurements: (Measurements in parenthesis are for specimens from the Cofre de Perote-Orizaba region): Males: Total length, 348 (326); length of tail, 156 (138); hind foot, 35 (35); females: 350 (320)—156 (145)—35 (35); weight, (males) 210, (females) 170. The two pregnant females from the Cofre de Perote-Orizaba region weighed 98 and 152 grams.

Microtus mexicanus mexicanus (Saussure).—Mexican Meadow Mouse

Specimens examined: Puebla: 12–16 km NNE San Andrés, west slope Mt. Orizaba, 10,000–11,000 ft., 12; Laguna Salada (near Alchichica), 8,000 ft., 3. *Tlaxcala:* 8 km SW Tlaxcala, 7,500 ft., 4. *México:* Monte Río Frío, 45–55 km ESE Mexico City, 10,500 ft., 12; N slope Mt. Popocatepetl, 13,500 ft., 8; 23 km E Mexico City, 7,500 ft., 7; Lago Zempoala, 45 km SW Mexico City, 9,400 ft., 9.

Meadow mice are widely distributed over the central Mexican uplands, occurring in numbers wherever lodged grasses or marshy areas are found. Colonies occur in small marshy areas in otherwise desert regions, such as at Laguna Salada. In marshy situations their surface runways often lead into shallow water; in the Llando Grande in the Río Frío mountains east of Mexico City, surface runways were little used, the mice utilizing shallow subterranean burrows to travel to and from the feeding areas.

Although living under diverse environmental conditions at elevations ranging from 7,500 to 14,000 feet, from desert surroundings to timber line, little geographic variation is evident in the material at hand. Specimens from Mount Orizaba have longer, narrower crania than those taken elsewhere; variations otherwise appear to be individual.

The breeding season extends at least from May through August, the interval between

litters being approximately 30 days. Half-grown young were taken June 25, July 17–20, August 17–20. On August 17, females containing embryos that would have been born about two weeks later were taken. The average number of young per litter was three.

Pitymys quasiater (Coues).—Mexican Pine Mouse

Specimens examined: Veracruz: 5 km N Jalapa, 4,500 ft., 3.

These mice were inhabiting a marshy area at the upper end of an artificial pond. They were caught in traps set in *Microtus*-like runways. One female (August 3) contained a single, nearly full term fetus.

Mus musculus brevirostris Waterhouse.—House Mouse

Specimens examined: Nuevo Leon: Río Ramos, 20 km NW Montemorelos, 1,000 ft., 1. *Hidalgo:* Río Tasquillo, 26 km E Zimapan, 5,300 ft., 1; 97 km N Mexico City (9 km SW Pachuca), 8,400 ft., 1; 85 km N Mexico City (9 km S Pachuca), 8,200 ft., 1. *México:* 23 km E Mexico City, 7,500 ft., 1. *Tlaxcala:* 13 km NE Tlaxcala, 7,800 ft., 1; 8 km SW Tlaxcala, 7,500 ft., 3. *Puebla:* 12 km NNE San Andrés, W slope Mt. Orizaba, 10,000 ft., 1. *Veracruz:* Boca del Río, 10 ft., 1; Guadalupe Victoria, 8,300 ft., 4; N slope Cofre de Perote, 10,500 ft., 1.

House mice are common in central México, both as feral animals and as commensals. They occupy a wide range of climatic and biotic conditions—from sea level to an elevation of at least 10,500 feet, and from the tropics, through arid lands, to coniferous clad mountains.

I have followed Schwarz and Schwarz (1943, p. 64) in referring these mice to the subspecies *brevirostris*.

One female taken July 20 was lactating; another trapped July 25 contained five nearly full term embryos.

Rattus norvegicus (Erxleben).—Norway Rat

Specimens examined: México: 5 km NW Texcoco, 7,600 ft., 2; 23 km E Mexico City, 7,500 ft., 2.

At the time of our visits to these localities (August), these rats were numerous along canals, drain ditches, and in the marshes, where their surface runways were conspicuous. No young rats were captured, nor was the single female taken pregnant or lactating.

Rattus rattus alexandrinus (Geoffroy).—House Rat

Specimens examined: Puebla: 12 km NNE San Andrés, W slope Mt. Orizaba, 10,000 ft., 1. *Guerrero:* Río Aguacatillo, 30 km N Acapulco, 1,000 ft., 2.

House rats were common commensals in the habitations of man in all parts of México visited by our parties. They were not restricted to man-made structures, however, as specimens living in the out-of-doors were trapped. Our specimens are all young.

Sylvilagus floridanus orizabae (Merriam).—Florida Cottontail

Specimens examined: México: 23 km E Mexico City, 7,500 ft., 1; Monte Río Frío, 45 km ESE Mexico City, 10,500 ft., 1. *Tlaxcala:* 13 km NE Tlaxcala, 7,800 ft., 1.

Florida cottontails are common in central México and exhibit a wide range of tolerance to climatic conditions, occurring in the maguey deserts, the encinal belt, and the pines at higher elevations, where they occupy the sacaton-covered hillsides and meadows. A female taken July 21 was lactating.

These specimens differ from typical *orizabae* in larger skull and shorter hind foot.

Sylvilagus cunicularis cunicularis (Waterhouse).—Highland Cottontail

Specimens examined: México: Monte Río Frío, 45 km ESE Mexico City, 10,500 ft., 4; Lago Zempoala, 45 km SW Mexico City, 9,400 ft., 1.

This large cottontail was common in the sacaton-covered openings in the coniferous forests where it occurred in association with the volcano rabbit (*Romerolagus diazi*) and a

smaller cottontail (*Sylvilagus floridanus orizabae*). In the tall grass it was difficult to see and more difficult to capture. One of the males, taken June 27, was a half-grown young; a female collected a day later contained five large embryos, suggesting at least two breeding periods a year.

Sylvilagus cunicularis pacificus (Nelson).—Highland Cottontail

Specimens examined: Guerrero: 53 km SW Tierra Colorada, 500 ft., 1; Río Aguacatillo, 30 km N Acapulco, 1,000 ft., 1.

The heavy chaparral at these stations was the home of this cottontail. Its habits are similar to those of its relative in the coniferous forests. A female taken August 3 was lactating.

Romerolagus diazi (Diaz).—Volcano Rabbit

Specimens examined: México: Monte Río Frío, 45 km ESE Mexico City, 10,500 ft., 4.

These small tailless rabbits usually inhabit the dense stands of sacaton grass in the open meadows, but they also frequent crevices in rocky hillsides. They spend much time in underground burrows, which seemingly they dig for themselves, and when above ground, largely early in the morning and late in the afternoon, they resort to runways in the grass. One may work for days in an area in which they live and never see them.

Breeding seems to be restricted to early spring, March and April A specimen taken June 26 was about one-fourth grown; another taken two days later was about three-fourths grown. These meager data suggest two litters.

Pecari angulatus humeralis (Merriam).—Collared Peccary

Specimen examined: Guerrero: Río Aguacatillo, 30 km N Acapulco, 1,000 ft., 1.

Collared peccaries were fairly numerous in the brush-covered hills north of Acapulco where they are hunted continuously by the local Mexicans for food. Our specimen, a large female containing two embryos, was killed August 5 with a machete wielded by a small boy twelve years of age. The effectiveness of this weapon in close combat is attested to by three deep gashes in the skull of the animal.

Among named races, this peccary is most like *humeralis*, the skull nearly duplicating in size that of the type (see Merriam, 1901b).

Measurements: Total length, 992; length of tail, 53; hind foot, 214; height at shoulder, 526. Skull: Basal length, 201.5; greatest breadth across squamosals, 99; palatal length, 149; length of upper molariform series, 67.1.

Odocoileus virginianus mexicanus (Gmelin).—White-tailed Deer

Specimen examined: Mexico: Monte Río Frío, 55 km ESE Mexico City, 10,500 ft., 1.

In the canyons on the west-facing front of the Monte Río Frío range, northwest of the town of Río Frío, our party encountered abundant sign of deer, but the brush was so dense that only one was seen. A few deer range in summer on the north slope of Mt. Ixtaccihuatl above an elevation of 11,000 feet, but, according to reports from local inhabitants, most of them keep to the mixed timber between 9,000 and 11,000 feet. Our specimen, an adult male in the velvet, was taken at the divide near Llano Grande where it was found dead and reported to us by a sheepherder.

Measurements: Total length, 1360; length of tail, 235; hind foot, 410; ear from notch, 63; height at shoulder, 915; weight, approximately 130 pounds. Skull: Condylobasal length, 262; width across orbits at juncture of frontal and jugal, 114.5; length of nasals, 76.6; mastoid breadth, 96.5; maxillary tooth row, 70; mandibular tooth row, 74.2.

LITERATURE CITED

ALLEN, G. M. 1916. Bats of the genus Corynorhinus. Bull. Mus. Comp. Zool., vol. 40, no. 9, pp. 333–356, 1 pl.

ALLEN, J. A. 1901a. A preliminary study of the North American opossums of the genus Didelphis. Bull. Amer. Mus. Nat. Hist., vol. 14, art. 11, pp. 149–188, pls. 22–25.

——— 1901b. Descriptions of two new opossums of the genus Metachirus. Bull. Amer. Mus. Nat. Hist., vol. 14, art. 15, pp. 213–218.

——— 1902. A preliminary study of the South American opossums of the genus Didelphis. Bull. Amer. Mus. Nat. Hist., vol. 16, art. 20, pp. 249–279.

BAILEY, VERNON. 1916. Revision of the pocket gophers of the genus Thomomys. U. S. Dept. Agric., Bur. Biol. Surv., N. Amer. Fauna, no. 39, pp. 1–136, 10 figs., 8 pls.

DAVIS, W. B. 1942. Swimming ability of two small mammals. Jour. Mamm., vol. 23, no. 1, p. 102.

GOLDMAN, E. A. 1911. Revision of the spiny pocket mice. U. S. Dept. Agric., Bur. Biol. Surv., N. Amer. Fauna, no. 34, pp. 1–70, 6 figs., 3 pls.

HATFIELD, D. M. 1936. A revision of the Pipistrellus hesperus group of bats. Jour. Mamm., vol. 17, no. 3, pp. 257–262, 1 fig.

HOWELL, A. H. 1914. A revision of the American harvest mice (Genus Reithrodontomys). U. S. Dept. Agric. Bur. Biol. Surv., N. Amer. Fauna, no. 36, pp. 1–81, 6 figs., 7 pls.

——— 1938. Revision of the North American ground squirrels, with a classification of the North American Sciuridae. U. S. Dept. Agric., Bur. Biol. Surv., N. Amer. Fauna, no. 56, pp. 1–256, 20 figs., 32 pls.

MERRIAM, C. H. 1894. Preliminary descriptions of eleven new kangaroo rats of the genera Dipodomys and Perodipus. Proc. Biol. Soc. Washington, vol. 9, pp. 109–116.

——— 1895a. Revision of the shrews of the American genera Blarina and Notiosorex. U. S. Dept. Agric., Div. Ornith. and Mamm., N. Amer. Fauna, no. 10, pp. 5–34, 2 figs.

——— 1895b. Monographic revision of the pocket gophers, family Geomyidae (exclusive of the species of Thomomys). U. S. Dept. Agric., Div. Ornith. and Mamm., N. Amer. Fauna, no. 8, pp. 1–220, 71 figs., 19 pls., 4 maps, frontispiece.

——— 1898. A new genus (*Neotomodon*) and three new species of murine rodents from the mountains of southern Mexico. Proc. Biol. Soc. Washington, vol. 12, pp. 127–129.

——— 1901a. Descriptions of 23 new harvest mice (Genus Reithrodontomys). Proc. Washington Acad. Sci., vol. 3, pp. 547–558.

——— 1901b. Descriptions of four new peccaries from Mexico. Proc. Biol. Soc. Washington, vol. 14, pp. 119–124.

MILLER, G. S., JR. 1897. Revision of the North American bats of the family Vespertilionidae. U. S. Dept. Agric., Div. Biol. Surv., N. Amer. Fauna, no. 13, pp. 1–135, 40 figs., 3 pls.

MILLER, G. S. AND G. M. ALLEN. 1928. The American bats of the genera Myotis and Pizonyx. Bull. U. S. Nat. Mus., no. 144, pp. viii + 1–218, 15 figs., 13 maps, 1 pl.

NELSON, E. W. AND E. A. GOLDMAN. 1929. Four new pocket gophers of the genus Heterogeomys from Mexico. Proc. Biol. Soc. Washington, vol. 42, pp. 147–152.

——— 1930. The pocket gophers of the genus Orthogeomys. Jour. Mamm., vol. 11, no. 2, pp. 155–159.

——— 1934a. Pocket gophers of the genus Thomomys of the Mexican mainland and bordering territory. Jour. Mamm., vol. 15, no. 2, pp. 105–124.

——— 1934b. Revision of the pocket gophers of the genus Cratogeomys. Proc. Biol. Soc. Washington, vol. 47, pp. 135–154.

OSGOOD, W. H. 1909. Revision of the mice of the American genus Peromyscus. U. S. Dept. Agric., Bur. Biol. Surv., N. Amer. Fauna, no. 28, pp. 1–267, 12 figs., 8 pls.

SANBORN, C. C. 1937. American bats of the subfamily Emballonurinae, Field Mus. Nat. Hist., zool. ser., vol. 20, no. 24, pp. 321–354, figs. 37–48.

SCHWARZ, E. AND H. K. SCHWARZ. The wild and commensal stocks of the house mouse, *Mus musculus* Linnaeus. Jour. Mamm. vol. 24, no. 1, pp. 59–72.

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GENERAL NOTES

MATING BEHAVIOR OF DIPODOMYS ORDII RICHARDSONI

A review of literature on kangaroo rats reveals that little has been published describing observations on their mating behavior. Ernest Thompson Seton (Lives of Game Animals, Doubleday, Doran and Co., Garden City, N. Y., 1929, p. 431) states, writing of *Dipodomys deserti*, "But he (the Kangaroo Rat) would be unlike all his kinsfolk if he did not have sounds to express greeting, pain, anger, and pleasure—yes, even a prolonged love-song for the mating season." On p. 436, Seton says that the mating behavior is unknown. Vorhies and Taylor (Life History of the Kangaroo Rat, *Dipodomys spectabilis spectabilis* Merriam, U. S. D. A. Bull. 1091, 1922) do not comment on this phase of the life-history of the Kangaro Rat. Vernon Bailey apparently missed observing the mating behavior of *Dipodomys*, despite his unexcelled skill in handling and observing small mammals. His discussions (Mammals of New Mexico, N. A. Fauna 53, Dec. 1931, pp. 254–259) of *D. s. spectabilis* deal principally with development of the young, which were successfully raised by a female bred in captivity; while of *Perodipus montanus richardsoni* (= *D. ordii richardsoni*) he says (p. 271), "Out of a large number of specimens collected, there are no very small young taken late in the season, and it seems probable in their zone and climate that not more than one litter is raised in a year." Of *Perodipus ordii columbianus* (= *D. o. columbianus*), Bailey says, "Apparently no small young have ever been found, and little is known of the breeding habits" (The Mammals and Life Zones of Oregon, N. A. Fauna 55, June 1936, p. 238). Ernest S. Booth (Observations on the Kangaroo Rat in Captivity, The Murrelet, 21 (1): 10–11, Jan.–Apr. 1943) failed to get pairs of *D. o. columbianus* to breed either without or with injections of "Gonadin."

The breeding habits of *D. o. richardsoni* differ markedly from those of most of the rodents with which I am familiar, and, therefore, presented in detail, may prove of interest to others.

In the fall of 1938, I captured several kangaroo rats and kept them in my garage at Amarillo, Texas. Each animal was housed in a separate cage, the upper portion of which was an 18″ x 18″ x 10″ basket of ¼″ mesh hardware cloth. This was attached to a 20″ x 20″ board floor in such a way as to permit the raising of one side of the basket to release the inmate. A coffee can, with a hole in the side served as a nest and cotton was supplied for nest-lining.

Each evening the cages were placed some distance apart on the concrete floor of the garage and the kangaroo rats were released. Here they were supplied with a variety of native grass and weed seeds, and with a small dish of water, which, incidentally, they drank avidly in considerable amounts immediately upon release. A small box of soil, about 6 inches deep was provided for dusting purposes and was much used. This box of soil, as will be seen, figured prominently in the breeding activities.

On the evening of November 13, 1938, two males and a female were released on the floor of the garage at about 8:05 p.m. At 8:10 the female started pursuing one of the males. This chase took place continuously for a 15-minute period. There was much sparring with the forefeet, and at each opportunity the female nosed the genitalia of the male. During the next 20 minutes the procedure was reversed, wtih the male in pursuit and nosing the genitalia and thoracic region of the back of the female. His attentions were vigorously re-

pelled at first, but resistance gradually weakened. Toward the end of this phase of courtship the male repeatedly pushed under the female from the rear forward, and occasionally from front to rear. The dorsal gland may have come into play at this time, although there was no positive evidence. There was much pursuit by the male throughout this phase, and each chase ended in the box of soil.

At 8:50, after frequent attempts by the male to secure a grip at the back of the female's neck, copulation took place. By 9:10 this pair had copulated 13 times. Each action occurrred while they were in the box of earth, and lasted 25 seconds or more, the length of time gradually increasing. Termination occurred when the female would leave the box. A chase would follow. After one coition the male squealed shrilly three times, and my notes state, "This is the only true squeal heard under any circumstances to date." I do not think that these sounds had any significance as part of the breeding behavior.

At 9:15 the pursuit began again, and was again followed by coition. The duration of coitus was much longer than previously. The action lasted 2 minutes, 30 seconds, and 2 minutes, 5 seconds, on two occasions. There was vigorous action on the part of the male and complete passiveness in the female.

On November 14th there was no evidence of sexual activity, nor had there been on the night of the 12th. Relatively neutral behavior toward each other was resumed. The male had been mildly dominant over the female prior to mating, but this situation apparently reversed, for on the 20th there was a short fight between these two from which the male, for the first time, fled. The second male, although noticeably larger than either of the others, was dominated by both, and took no interest nor part in the mating. He was chased and savagely attacked by the other male until caged.

I regret to report that this mating was a failure. The kangaroo rats were kept for several months. No young were produced, nor was there evidence of pregnancy. This information, however, may serve as a guide to others who study the life-history of these interesting small mammals. It seems as though four factors may enter into the successful breeding of kangaroo rats in captivity, namely, time of year, separate cages, a roomy area for exercise, and a box of soil as a place to groom and mate.

I wish to acknowledge the courtesy of Dr. H. H. T. Jackson in reviewing for me the literature and records of the U. S. Fish and Wildlife Service on this subject at the Patuxent Wildlife Refuge.—PHILIP F. ALLAN, *Soil Conservation Service, Washington, D. C.*

WATER CONSUMPTION OF CERTAIN MICE IN RELATION TO HABITAT SELECTION

While engaged in population and physiological studies of small mammals at the Mountain Lake Biological Station, Mountain Lake, Virginia, during August 1942, the writer kept a number of mice under observation in captivity. It was immediately noticed that the red-backed mouse, *Clethrionomys gapperi maurus*, drank much more frequently than the other species under observation. To determine the amount consumed, eleven mice of four species were placed in separate cages, each supplied with a nest box and a self-feeding water bottle consisting of an inverted 150 cc. bottle carrying a rubber stopper and straight glass tube. All mice immediately learned to drink from the end of the tube and, except possibly for an insignificant amount lost by evaporation, no water was wasted. The mice were fed on the same diet, consisting of approximately equal parts of peanuts, oats, and raisins. Since windows were kept open, conditions of temperature and humidity in the laboratory room were nearly the same as outside where, at 3800 feet altitude, a cool moist summer climate prevailed.

The results of the experiments are shown in Table 1. Although the number of individuals is small, the difference in water consumption between *Clethrionomys* and *Peromyscus* was very striking, the former consuming nearly ten times as much water as the latter. *Clethrionomys*, in fact, consumed nearly its weight in water each day! It does not seem reasonable that this difference in water consumption could be due to conditions of captivity. All mice maintained their weight throughout the experiment, and the amount of water taken the first day of captivity was about the same as on subsequent days. *Clethrionomys*, both in the wild state and in captivity, was observed to be active both day and

night. Nearly every time these mice ventured out of their nest boxes they drank, whereas the other species drank only at infrequent intervals. The red-backed mice also lost a great deal more water by way of the urine; the paper under the cages of these mice was usually quite wet, whereas the paper under cages of other species remained dry. While these experiments do not necessarily indicate the amount of water actually taken under natural conditions, apparently they do indicate an interesting species difference in basic water metabolism.

Within its range, *Clethrionomys gapperi* is generally reported to be most common in moist, cool situations. At Mountain Lake the following habitats were trapped: upland fields, herb stages; upland fields, shrub stages; oak-chestnut, second growth; oak-chestnut, mature; ridge top oak heath; stream side forest; mountain top heath bald; sphagnum bog; red spruce-hemlock (cut over); and lakeside hemlock-yellow birch. *Pitymys* is rare in the region, the individual tested being the first record. Both species of *Peromyscus* were found in all habitats, whereas *Clethrionomys* was found only in the last four listed above, which are

TABLE 1.—*Water consumption of four species of mice*[1]

SPECIES	SEX	WEIGHT	LENGTH OF EXPERIMENT	TOTAL WATER CONSUMED	WATER CONSUMED PER 24 HOURS
		grams	*days*	*cc.*	*cc.*
Peromyscus leucopus noveboracensis	♂	25.2	10	22	2.2
" " "	♂	19.7	6	18	3.0
" " "	♂	24.0	10	27	2.7
" " "	♀	21.3	10	22	2.2
" " "	♀	24.2	10	29	2.9
	Ave.	22.9	—	—	2.6
Peromyscus maniculatus nubiterrae	♀	17.3	10	18	1.8
Clethrionomys gapperi maurus	♂	33.8	10	284	28.4
" " "	♂	27.0	4	84	21.0
" " "	♀	25.9	5	137	27.4
" " "	♀	23.8	4	92	23.0
	Ave.	27.9	—	—	25.0
Pitymys pinetorum	♂	18.2	7	38	5.5

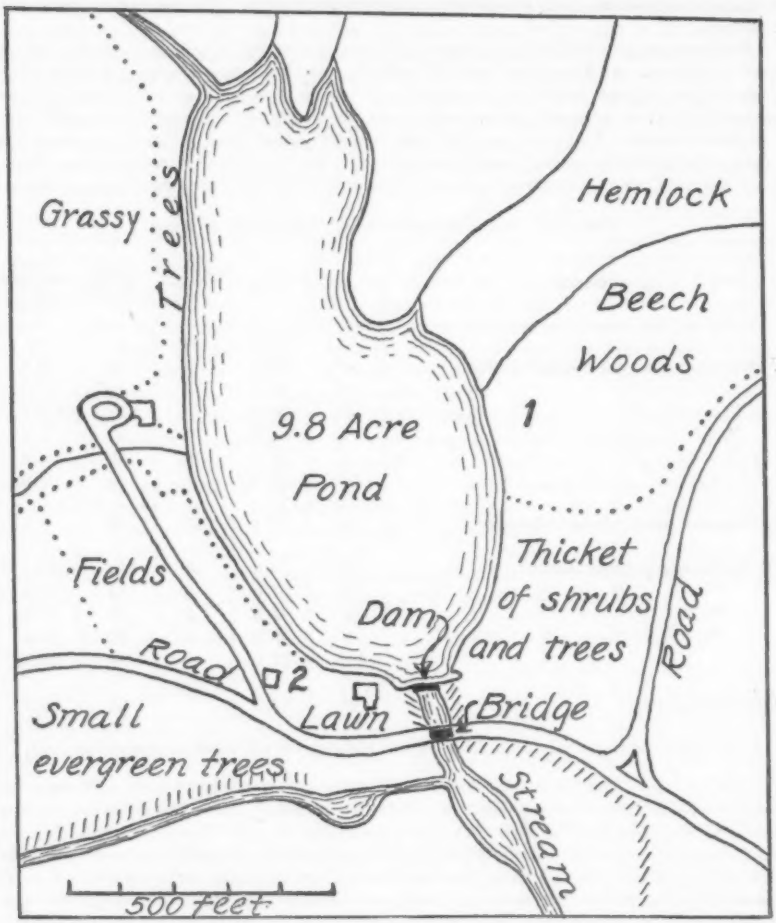
[1] The writer is indebted to Dr. Remington Kellogg for sub-specific determinations.

also the wettest. The heath bald (located on Bald Knob) would not appear off hand to be a wet situation, but there was plenty of available water in the form of rock pools and a heavy blueberry crop on which the mice were largely feeding in August. Furthermore, within the moist plant communities, especially the hemlock and spruce, red-backed mice were usually most abundant in the wetter spots near streams, springs, seepages, or mossy areas; in such spots they outnumbered *Peromyscus*. Perhaps, therefore, the high water requirement of *Clethrionomys* is a limiting factor in habitat selection; this might be especially true near the periphery of the range where other factors such as temperature were becoming critical. At least there seems to be an interesting correlation between an easily measured physiological requirement and the observed distribution in nature.—EUGENE P. ODUM, *Department of Zoology, University of Georgia, Athens, Georgia.*

HOMING OF PEROMYSCUS MANICULATUS GRACILIS

In a study of body temperatures, white-footed mice were caught alive in Sherman traps in a hemlock-beech forest (1 in map) at the Edmund Niles Huyck Preserve, Rensselaerville,

New York, during the summer of 1942. These mice were confined in cages inside a barn that served as a laboratory. Each mouse was individually identified by toe clipping. Two of these mice escaped during handling and their records of recapture are of special interest as they indicate considerable homing ability.



As shown on the accompanying map, one mouse, an adult male, was first caught at "1" on July 11, but was purposely returned to the woods in the morning of July 12. At 9:30 a.m., July 13, it was recaptured at "1" and brought to "2" where it escaped at 6:00 p.m. the same day. The next morning, July 14 at 9:40 a.m., it was again found in a trap at "1" having returned during the night.

Another mouse, also an adult male, was first captured at "1" on July 11 and taken to "2". On July 12 at 9:30 a.m. it escaped at "2". On July 13 at 9:30 a.m. it was recaptured at "1".

At 5:45 p.m. the same day, it again escaped at "2" and on July 14 at 9:40 a.m. it was again recaptured at "1".

The shortest distance around the end of the pond was 800 feet from the place of escape to the place of recapture. The distance traveled by the mice must certainly have been greater as they had to find their way out of the barn, across a medium-sized lawn, across a stream, and find their way through a dense thicket of shrubs and trees back into the woods. The outlet stream from the pond falls over a dam into a small ravine. At this time of the year the stream was a mere trickle and the stream bed was filled with rocks over which the mice might possibly have traveled by leaping from one rock to another. Another possible stream crossing could have been over the road bridge. In either case, the prompt return of the mice over what would seem to be a difficult route indicates a good knowledge of the terrain over an area probably wider than their usual home range.—S. Charles Kendeigh, *University of Illinois Champaign, Illinois.*

SURVIVAL VALUE OF VOICE IN SMALL MAMMALS

That the screams of mice and rats, and perhaps of other small mammals, may actually have some survival value was made evident recently when a live, tame white rat was offered to a pet coatimundi (*Nasua narica* subsp.) from Chiapas, Mexico. When the rat was shown to the coati, the latter pranced about in great eagerness. On earlier occasions the coati had shown extraordinary avidity for small vertebrates such as snakes and birds, and, as was expected, it pounced upon the rat without hesitation. The latter, after being mauled about for a few seconds but not seriously injured, began screaming in a piercing note entirely unlike the usual voice of its kin. The coati abruptly left the rat, but as the noise ceased went back after its prey with the original enthusiasm. Again the rat screamed, and as before the coati ran a few feet away, showing signs of discomfort by shaking the head. After some hesitation the coati returned, but when dispelled again by the same method, did not show further interest in the rat, which remained huddled helplessly in a corner until returned to its cage. The coati had not been injured in any way by its brief contact with the rat.—Hobart M. Smith, *University of Rochester, Rochester, New York.*

HOUSING OF THE POCKET GOPHER IN CAPTIVITY

A number of popular books on pets refer to the difficulty of maintaining pocket gophers in captivity. Any mammalogist desiring to keep them for experimental purposes may find the following techniques of value.

It was found that in natural cages containing soil, gophers (*Thomomys bottae pascalis*) usually exhausted themselves by excessive digging and soon died. Also the quantity of urine excreted is so great that such cages tend to become "sour". To avoid these difficulties gophers were placed in cages originally designed for white rats. Each cage was constructed of 6 squares of ½ inch mesh wire gauze, 12 inches on the edge. These were laced together with bare copper wire along their edges to form cubes. An entrance 4½ inches square was cut from one side, which was to become the top. A 5 inch square door was hinged over this with windings of bare copper wire. The latch consisted of a couple of twists of the same material. The cage bottom was bent upward about an inch at the middle until it had a concave form. The whole cube was then placed in a shallow square galvanized iron pan upon several layers of newspapers.

Gophers were readily kept in these containers. The papers had to be changed daily. The bent cage bottom furnished drainage and passed excrements onto the papers. No water was necessary. I have yet to see one of these rodents drink. The food consisted approximately of one half of the animal's weight of fresh vegetable matter each day. A few hard seeds, large enough so they will not fall through the gauze, seemed to be appreciated. Dry lima beans appeared to be satisfactory. The animals gritted their teeth together at intervals, possibly to help keep them in good condition. No attempt was made to keep two or more in the same cage.

This housing method brought out some interesting individual examples of adaptability.

The gophers usually ate from the hand after an hour or two of captivity. After a day or two they could be touched safely, although they never could be lifted without risk of a bite. If they were released for a few minutes, they recovered their ferociousness.

Originally the cage doors were built in the sides of the cages until one female learned that chewing the copper wire would bring freedom. After five such escapes in two days, the door had to be placed on the top of the cage. Although the gophers often walked upside down across the top of the cage they never seemed to do any gnawing in that position.

Rags placed in this female's cage caused the inmate a great deal of trouble since the threads became tangled in her long claws and teeth. In about a month this gopher had learned how to shred cloth for bedding almost as skillfully as a house mouse and, at the same time, avoid entanglement in the threads.

The sleep of these rodents was so sound that some sleeping individuals could be rolled about in the hands for a little while before they would awake. Awakening was sudden.

Twelve pocket gophers obtained in good condition were kept in the described cages for classroom observation for lengths of time varying from three weeks to six months. The only abnormality resulting seemed to be a slight obeseness, although no weights were recorded. Only one of these animals died as a captive. Its cage was left in the sun by accident on a hot day. Seven attempts to cage previously injured gophers in the same manner always led to death within two days.—GEORGE H. HANLEY, *2201 B St., Bakersfield, California.*

NOTES ON SMALL MAMMAL POPULATIONS AT MOUNTAIN LAKE, VIRGINIA

Methods of sampling small mammal populations are almost as numerous as the investigators using them, but, in general, technics seem to fall into two groups—(1) the trap night or trap line method (in which traps are left out one night) usually used in rapid surveys to determine relative abundance and distribution, and (2) the quadrat method (in which traps remain in a measured area for 3 or 4 nights) used to determine absolute abundance in blocks of more or less uniform habitat. Combining the two methods would seem to give the best picture of abundance on the average diversified area that contains not only uniform habitat but many edges and sub-communities where animals are often concentrated. The following notes are based on trapping data obtained in August 1941 and August 1942 within a limited two mile radius of the University of Virginia's Mountain Lake Biological Station, Mountain Lake, Giles County, Virginia. The area all falls within an altitude range of 3,500 to 4,363 feet (Bald Knob) so that habitat differences rather than altitude differences are of primary interest.

The following species of rodents and insectivors have been recorded from the station vicinity (specimens of those marked with an asterisk have been examined by Dr. Remington Kellogg, to whom the writer is indebted for subspecific determination): *Parascalops breweri*, **Sorex longirostris*, **Blarina brevicauda carolinensis*, *Marmota monax* (very local), *Tamias striatus*, *Tamiasciurus hudsonicus* (conifer woods only), *Sciurus carolinensis*, *Glaucomys volans*, **Peromyscus maniculatus nubiterrae*, **Peromyscus leucopus noveboracensis*, *Neotoma magister* (locally at Bald Knob, Bear Cliff and other rock slides), **Clethrionomys gapperi maurus*, **Pitymys pinetorum*, *Napaeozapus insignis*, *Sylvilagus transitionalis*. *Sorex longirostris* (2 specimens) and *Pitymys* (one specimen) were recorded for the first time in 1942. Not a single specimen of *Napaeozapus* was seen or taken in either 1941 or 1942, although it had been taken in the vicinity in years previous.

Attention was restricted largely to mice and shrews, which can be adquately sampled by the use of the ordinary snap-back mouse trap and the Sherman metal live trap. In both 1941 and 1942, small groups of 10–20 traps were set out for one night in a variety of habitats. In addition, five 100 x 100 ft. quadrats (approx. ¼ acre) were operated in 1942 in areas selected by plant ecologists as being the best examples of important plant communities of the region. Sixty traps were set in each quadrat and allowed to remain three nights with resetting and baiting each day, if necessary. Traps were set in burrows and other likely places, but an attempt was made to cover the quadrat uniformally.

Relative abundance.—The results of random trapping over the area as a whole are shown

below. Relative density is expressed as a percentage of the number of individuals caught divided by the total number of traps. Approximately the same number of traps were set in the same places both years.

	1941	1942
Peromyscus leucopus noveboracensis	6.2	29.6
Peromyscus maniculatus nubiterrae	5.4	7.0
Blarina brevicauda carolinensis	3.1	4.9
Clethrionomys gapperi maurus	2.3	3.5
Total	17.0	45.0

The small species thus seemed to be more than 2.5 times as abundant in 1942, with an animal occuring in nearly every other trap. *P. leucopus* seemed to have increased proportionally to a much greater extent than the other species. The total catch by habitats in 1942 was as follows: Station vicinity (forest edge) 90 percent, heath bald (top of Bald Knob) 44 percent, stream border forests, 42 percent, hemlock-yellow birch, 40 percent, oak-chestnut, 25 percent, abandoned clearings, (herb and shrub stages), 19 percent. Mice, particularly, *P. leucopus*, are attracted to the vicinity of buildings and cabins, which they enter freely, especially in years of high population like 1942. The heath bald had a surprisingly large population, which seemed to be correlated with the heavy blueberry (*Vaccinium* and *Gaylussacia*) crop. All stomachs of all three species of mice from this area (no shrews taken here) were crammed full of blueberry pulp, and neat piles of seed under the bushes supplied additional evidence of heavy feeding on this item. It is likely that mice move from the woods into the "balds" during the late summer fruiting season. It is interesting to note, in passing, that in case of larger seeded species of blueberries, few seeds are swallowed, but rather are discarded into piles. The lowest catch was made in the dry oak-chestnut and clearings.

Quadrat studies.—The five 100 by 100 ft. quadrats were located as follows: (1) oak-chestnut, mature (one half mile north of station, 100 yds. to right of the "West Virginia road"); (2) oak-chestnut, young (one-fourth mile southeast of station near trail to spring); (3) hemlock-yellow birch (forest at north-east corner of Mountain Lake); (4) red spruce-hemlock, cut-over (headwaters of Saltpeter branch); (5) Sphagnum bog (adjoining Twin Springs). Oak-chestnut, much modified by the blight and cutting, and ranging from dry ridge top forest (with *Pinus rigida*) to moist stands, is the prevailing vegetation of the study area and the probable climatic climax. Hemlock is a postclimax occupying ravines and other moist situations. Spruce has been nearly all removed by lumbering and was probably more prominent in the past. The sphagnum bog is, of course, a very local habitat. The number of animals *per acre* in these habitats as indicated by the quadrat samples in 1942 was as follows:

	Oak-chestnut mature	Oak-chestnut young	Hemlock Y. birch	Spruce	Sphagnum
P. l. noveboracensis	26	22	4	4	13
P. m. nubiterrae	8	13	17	13	17
B. b. carolinensis	4	17	8	0	8
C. g. maurus	0	0	35	13	4
Total animals (per acre)	38	52	64	30	42

The quadrat trapping, of course, gives a somewhat different population picture than random trapping, since the emphasis is on determination of absolute abundance in large habitat blocks where density is often nowhere near as great as in "edge" habitats (300 quadrat traps, for example, did not catch as many animals as 100 "edge" traps). Of the important large communities, the moist lake-side hemlock-yellow birch had the highest population. The relatively high population in the young oak-chestnut as compared with the

mature is probably to be correlated with large number of well-decayed logs in the former left over from blight and cutting inroads. Quadrat no. 2 was the only one that was also operated in 1941 when only 2 animals (about 8 per acre) were caught, indicating as did random trapping that 1941 was a "low" year in small mammal abundance.

Habitat selection.—Both species of white-footed mice occurred together in nearly all habitats (*maniculatus* was not taken in clearings), but there appeared to be a consistent difference in proportions in 1942. In the moist habitats—hemlock, spruce, sphagnum, stream borders (see above)—*maniculatus* outnumbered *leucopus*, whereas in the vast stretches of dryer oak-chestnut much the reverse was true. Although the two species are similar in appearance (Mt. Lake specimens can, however, be easily distinguished by tail characters, *maniculatus* having a longer, more bushy-tipped, and more bicolor tail), Dice (Jour. Mamm., vol. 14, p. 298, 1933) has shown that they are genetically quite distinct and do not interbreed. Distinct habitat differences may also occur. In the mid-west, for example, *P.l. noveboracensis* is a forest inhabitant whereas *P.m. bairdi* frequents prairies. *Blarina* was widely distributed at Mt. Lake showing no marked habitat preference. *Cleithrionomys*, on the other hand, is definitely limited by habitat, not occurring at all in the general run of oak-chestnut and being most abundant in moist habitats, especially coniferous associations. As I have indicated elsewhere (p. 404, this publication), direct water relations may be an important limiting factor, correlation with vegetation being secondary.—Eugene P. Odum. *Dept. of Zoology, University of Georgia, Athens, Georgia.*

A GALL INSECT FOOD OF THE GRAY SQUIRREL

On May 31, 1943, at Falls Church, Virginia, several pinkish, wooly galls were opened by gray squirrels (*Sciurus c. carolinensis*). Examination of the remains revealed that most of the many woody capsules occupying the centers of the growths were opened and the insect larvae consumed. Mr. L. H. Weld, U. S. Department of Agriculture, has determined that the gall was formed by the cynipid *Callirhytis seminator* (Harris), the oak woolsower, and came from the white oak (*Quercus alba*).—George A. Petrides, *National Park Service, Washington, D. C.*

A NOTE ON NEOTOMA AND SYLVILAGUS IN NEW MEXICO

On May 10, 1943, while we were trapping for skunks under an adobe building at the headquarters area of the Jornada Experimental Range, Dona Ana County, New Mexico, a white-throated wood rat (*Neotoma albigula*) was caught in an unbaited steel trap set in a runway at a small hole in the adobe. Tightly held in the teeth of the wood rat was a well-furred young cottontail (*Sylvilagus auduboni*) 4½ inches long that apparently had been taken from a nest under the building. When discovered, both animals were dead.

Bailey (N. Amer. Fauna, no. 53, p. 180) cites Mearns, who accused wood rats of carrying off various articles, including bird skins and hen's eggs. Bailey (*ibid.* p. 179) also speaks of the fact that although the wood rat is predominantly vegetarian in food habits, it will take "almost any kind of meat, cooked or raw" as trap bait. Vorhies and Taylor (Univ. of Arizona Tech. Bull. no. 86, 1940, pp. 496–504) in their study of the wood rat in Arizona also speak of the high percentage of vegetable food in the diet of this rodent. Our observation is not conclusive as to whether the cottontail was to be used as food or was merely being carried away, but it suggests the possibility of cottontail predation by the wood rat in this Lower Sonoran habitat.—Arthur F. Halloran, *San Andres National Wildlife Refuge, Las Cruces, New Mexico.*

CALIFORNIA LYRE SNAKE FEEDING ON THE POCKETED BAT

On March 23, 1943, while observing a small colony of bats located in a rock crevice two miles southeast of the Suncrest Store, San Diego County, California, I captured a California lyre snake (*Trimorphodon vandenburghi*) in a crack used by the pocketed bat (*Tadarida femorosacca*) for roosting purposes.

The snake showed signs of having recently fed, and upon further examination, proved to have eaten one of these bats.

It is worthy to note that this reptile is also on record for having preyed upon the cave bat (*Myotis velifer velifer*) (Stager, Jour. Mamm., vol. 23, no. 1).

These observations seem to indicate that this snake is an enemy of bats, at least of those varities found in and about its rocky habitat. That the snake is a mildly poisonous species might give some clue to its ability to capture successfully such agile prey within the confines of an inch wide crack where constriction would be almost impossible.—PHILIP H. KRUTZSCH, *1536 31st Street, San Diego, California.*

FURTHER NOTES ON THE RICE RAT IN DELAWARE

Under General Notes of the Journal of Mammalogy for February 1943, Miss Viola S. Schantz recorded the rice rat (*Oryzomys p. palustris*) from Delaware for the first time. The writer wishes, at this time, to record four more Delaware specimens. Originally planned for publication early in 1941, the writer's call to service with the U. S. Army in March of that year caused these notes to be forgotten. Miss Schantz' interesting article has provided the stimulus for the following remarks.

Between December 25 and December 28, 1916, three specimens were trapped near Odessa, Newcastle County, Delaware, by Samuel Mason and later acquired by Samuel N. Rhoads. Consisting of skins and skulls, they are nos. 12891, 92 and 93 in the mammal collection of the Academy of Natural Sciences of Philadelphia.

On November 6, 1932, Drs. Robert K. Enders and Francis Harper collected a subadult male rice rat at Bombay Hook, Kent County, Delaware. Their notes are as follows: "Total length—194 mm; tail—94 mm; hind foot—27 mm; ear 14mm (from crown). Weight—29.3 grams. Testes—5 x 3 mm. Border between oak woods and salt marsh, among *Panicum virgatum* and *Baccharis halimifolia* in muskrat trail." The skin and skull are A. N. S. P. no. 16418.

The writer obtained the permission of John F. Herholt, Refuge Manager, to trap for rice rats on the Bombay Hook Wildlife Refuge at Smyrna, Delaware on March 31, 1940. Traps were set on and around several muskrat "houses" with a resulting catch of two meadow mice (*Microtus p. pennsylvanicus*), one leopard frog (*Rana pipiens*) and a tuft of hair which, upon microscopical examination, proved to be that of *Oryzomys p. palustris*.

Miss Schantz, in her remarks on the mutilation of trapped muskrats by rice rats, quotes Bachman (Audubon, J. J., and Bachman, John, Quadr. North Amer., vol. 3, p. 215, 1854) on the meat-eating propensities of the rice rat. Samuel N. Rhoads, in his "Mammals of Pennsylvania and New Jersey" (1903) has made the following interesting comments: Page 84—"Found on all tide marshes in this locality (Greenwich, N. J.). Uses same runs as the muskrat and gets caught in the same traps. Perfect specimens are hard to get, as they devour each other when fast in traps. . . . I think they are principally vegetarians, but when hungry will eat meat or anything that comes handy." Page 85—"They are considered a nuisance by muskrat trappers, as during ebb tide they prowl about the runways and "leads" of the rats and frequently spring their traps, even when under water. They also gnaw the bodies of the dead rats and mutilate their skins."—FREDERICK A. ULMER, JR., *Academy of Natural Sciences of Philadelphia, Philadelphia, Pa.*

EXTENSION OF RANGE OF THE MINK IN TEXAS

Fred H. Donovan, a former student at the Agricultural and Mechanical College of Texas, reported that Glenn Collier caught two minks (*Mustela vison mink*) about December 10, 1935, at Wanderers Creek, four miles southwest of Chillicothe, Hardeman County, Texas. The two skins were sent to Sears, Roebuck and Company and about $6.00 were received for one of them. Donovan reports that another mink was caught that winter in the same general locality, and that others have been taken at intervals, although further definite dates are not available.

The mink is well known in approximately the eastern half of Texas, occurring west to Gainesville (Cooke County), Brazos (Palo Pinto County), Mason (Mason County), Austin (Travis County), and the lower Guadalupe River. The present record carries the range of the animal more than 100 miles west of Gainesville along the northern boundary of the State.—WALTER P. TAYLOR, *Texas Cooperative Wildlife Research Unit, College Station, Texas.*

RECORDS OF MOUNTAIN GOAT AND MOOSE FROM WASHINGTON STATE

A mountain goat, *Oreamnos americanus*, was killed several years ago in a part of the state of Washington where goats were not previously known to occur. In view of the probability

FIG. 1. Pete Lemery with head of moose killed in Ferry County, Washington, November 16, 1929

that this specimen represents the first, and only, record of the subspecies *missoulae* in Washington it seems worthwhile to record the circumstances of its capture. Our information was obtained through the kindness of W. L. Woodard (formerly a game warden in Stevens County), H. C. Nickelsen (formerly a member of the Washington State Game Commission), and F. A. Youmans (Superintendent, Spokane State Trout Hatchery). In the fall of 1931, Mr. Woodard arrested Elmer Griffith for killing a goat two miles north of Deep Lake at the town of Leadpoint, Stevens County. The skin of the goat was confiscated and was stored for short periods at Spokane and at Auburn. Mr. Nickelsen eventually had it mounted and placed in the basement of his home in Tacoma, where we examined it on February 23, 1940. The goat was mounted in a standing position and appeared to be lacking the skull, although

this could not be verified without damaging the mount. The horns measured, in millimeters: length along convexity (anterior), right 185, left 187; circumference at base of right 109 (left-base buried in skin). The specimen can not be assigned positively to *missoulae* but in view of the fact that it was taken about 100 miles from the known range of the Cascade goat, subspecies *americanus*, and in the northeast corner of Washington where Rocky Mountain faunal elements are known to occur, this assignment seems highly probable.

The occasional presence of the moose, *Alces americanus shirasi*, in Washington is established by information which we have obtained from Mr. Pete Lemery, of Boyds, Ferry County. On June 15, 1938, we saw the body-skin and forefeet of a moose hanging on a rafter in Lemery's woodshed. The skin was dried, vermin-ridden, and dusty, but revealed that the natural color of the hair was almost black. Mr. Lemery shot the animal four miles southwest of Twin Lakes, Ferry County, on the Colville Indian Reservation, on November 16, 1929. In all probability the moose followed the Kettle River or the main Columbia River southward from the Canadian border, a distance of 60–75 miles. Mr. Lemery guessed the weight of the animal at 1400 pounds, and measured the spread of the antlers at 45 inches. There were seven points on the right antler and six on the left. The head was mounted on a panel and, in 1938, was hanging on a wall of the Guaranty State Bank, Colville. Mr. Lemery stated that a second moose was seen (by someone else) in September 1932, three miles north of Boyds.—Victor B. Scheffer, *U. S. Fish and Wildlife Service, Seattle, Washington*, and Walter W. Dalquest, *California Museum of Vertebrate Zoology, Berkeley, California*.

PORCUPINE RECORDS IN OKLAHOMA

On June 15, 1942, Whit Hadley, a local stockman, told me that a porcupine had been run over near the boundary fence of the Wichita Mountains Wildlife Refuge, Comanche County, several hundred feet north of the Indiahoma Gate. He also mentioned that this animal, which was previously mistaken for a large opossum, had been noticed several times after dark in the immediate vicinity. The skull was badly crushed, but the lower jaw was intact. Fragments of the skull and the lower jaw were submitted to Dr. H. H. T. Jackson, Fish and Wildlife Service, who kindly determined the specimen as referable to *Erethizon epixanthum bruneri*.

As W. F. Blair (Amer. Midland Nat., vol. 22, p. 127, July, 1939) has published the only previously known porcupine record for Oklahoma, the writer believed there might be additional unpublished records. A. E. Gray, district agent, Fish and Wildlife Service, in a letter of September 12, 1942, generously furnished the writer with several: In 1932, Mr. Gray personally noted the remains of a porcupine on Beaver Creek about 9 miles west of Laverne, Harper County; James C. Flynn, government trapper, reported finding an average size male porcupine on March 10, 1942, about 10 miles north of the Wichita Mountains Wildlife Refuge; and a newspaper clipping taken from the *Daily Oklahoman* published in Oklahoma City, for July 28 (?1942) reported a 30 pound porcupine captured near Eldorado in southwestern Jackson County. It will be noted that these five records of porcupines are confined to the western part of the state. From the records available, it would appear that an occasional porcupine either emigrates from its normal range, perhaps in search of a more suitable environment, or it may be possible that these animals have been released by man. This would explain restriction of occurrence to the western part of the state. It is possible that some may have been transported in carloads of lumber by rail. There are doubtless other unpublished records of porcupines in the state not known to the writer.—Frank B. McMurry, *Fish and Wildlife Service, Wichita Mountains Wildlife Refuge, Cache, Oklahoma*.

FOURTH RECORD OF THE POCKETED BAT IN CALIFORNIA

According to Neil (Jour. Mamm., vol. 21, no. 3, p. 356) there have been heretofore only three records of the pocketed bat (*Tadarida femorosacca*) in California. All of these locality records are located in the Lower Sonoran Zone near the edge of the Colorado Desert.

I recently collected a small series of these bats from a rock crevice two miles southeast

of the Suncrest Store, San Diego County, California. This locality is in the Upper Sonoran Zone. Such plant indicators as *Yucca whipplei*, *Adenostoma fasciculatum*, and *Quercus agrifolia* are found there in abundance. This record not only establishes the pocketed bat in the Upper Sonoran Zone, of the San Diegan Region, but it also extends its known range in California.—PHILIP H. KRUTZSCH, *1536 31st Street, San Diego, California.*

A RECORD OF LASIURUS BOREALIS TELIOTIS FROM ARIZONA

On June 12, 1943, Theodore W. Strum, a ten year old boy, brought me a live western red bat (*Lasiurus borealis teliotis*) that is now no. H502 in my vertebrate collection. Cahalane (Jour. Mamm., vol. 20, p. 422) previously reported *teliotis* from Cochise County, Arizona.

The bat, a female with two well-developed embryos, was found hanging on a fig leaf, about 7 feet above ground, at the north edge of Benson, San Pedro Valley, Cochise Co., Arizona, at an altitude of about 3600 ft., in high Lower Sonoran Zone. Although mesquite and catclaw constitute the dominant natural woods of the valley, groves of large cottonwoods and willows are to be found at the numerous ponds—resulting from artesian wells scattered throughout the valley—in the farmland of this vicinity. It was by one of these groves that the bat was found.

I am indebted to the Museum of Vertebrate Zoology, Berkeley, California, and particularly to Dr. E. Raymond Hall of that institution, for the identification of this specimen.—LYNDON L. HARGRAVE, *Benson, Arizona.*

STATUS OF THREE POCKET GOPHERS OF THE GENUS THOMOMYS

As a result of rather extensive, but by no means exhaustive, work on pocket gophers of the *Thomomys talpoides* group, a list of the subspecies, including several described as new, was published by the writer (Jour. Mamm., vol. 20, pp. 231–244, 1939). One of the races treated as new was *Thomomys talpoides badius* (*op. cit.* p. 242) from Wenatchee, Chelan County, Washington. To this race were assigned 78 specimens examined from various localities in the drainage area along the western side of the Columbia River, including the Yakima Valley. Through a coincidence *Thomomys talpoides yakimensis* was named over two weeks earlier by Hall and Dalquest (The Murrelet, vol. 20, p. 4, 1939) from Selah, Yakima Conty, Washington. I regard the two as identical, and the former name should, therefore, be placed in the synonymy of the latter.

In listing the names of pocket gophers assignable to the *Thomomys bottae* group (Proc. Biol. Soc. Wash. vol. 48, p. 155) I inadvertently included *Thomomys scapterus* Elliot (Field Columb. Mus. Publ. 87, Zool. Ser., vol. 3, p. 248, 1903) from Hannopee Canyon, Panamint Mountains, Inyo County, California. This name should be relegated to the synonymy of *Thomomys bottae perpes* Merriam, as indicated by Bailey (North Amer. Fauna no. 39, vol. 72, 1915).

Thomomys quadratus gracilis Durrant (Bull. Univ. Utah, vol. 29, no. 4, p. 3, 1939) from Pine Canyon, 17 miles northwest of Kelton, Box Elder County, Utah (altitude 6,600 feet) should stand as *Thomomys talpoides gracilis* Durrant.—E. A. GOLDMAN, *Fish and Wildlife Service, Washington, D. C.*

STATUS OF PEROMYSCUS NUTTALLI AUREOLUS

In describing a western subspecies of the golden mouse (Proc. Biol. Soc. Wash., vol. 54, p. 189, 1941) I expressed the opinion that *Peromyscus nuttalli aureolus* (Audubon and Bachman) from "In the oak forests of South Carolina" can not satisfactorily be distinguished from typical *Peromyscus nuttalli nuttalli* (Harlan) from Norfolk, Virginia. More detailed comparisons have since convinced me that *aureolus* is recognizable by smaller average size, narrower skull, and smaller teeth, as pointed out by Osgood long ago (North Amer. Fauna no. 28, p. 226, 1909). It seems desirable to publish this note in order to restore the record.—E. A. GOLDMAN, *Fish and Wildlife Service, Washington, D. C.*

THE NAME NEOTOMA CINEREA CINNAMOMEA ALLEN APPLIED TO WOODRATS FROM SOUTHWESTERN WYOMING

In my opinion, the bushy-tailed woodrats of the arid buttes and high plains of southwestern Wyoming warrant recognition as a distinct geographic race. Goldman (N. Amer. Fauna, no. 31, pp. 104–105, 1910), and Hooper (Univ. California Publ. Zool., vol. 42, pp. 420, 422, 1940) following Goldman, included them with *Neotoma cinerea orolestes* Merriam, although the former author pointed out that rats from certain localities "are paler than typical *orolestes*." For the populations of that area the name *cinnamomea* Allen is available, and has been applied to eight specimens in the University of Michigan Museum of Zoology from the following four localities in Wyoming: **Sweetwater County:** five miles east of Rock Springs, Thayer Junction, and six miles south of Point of Rocks. **Uinta County:** ten miles southwest of Granger. The locality "six miles south of Point of Rocks" is about 25 miles north-northwest of Kinney Ranch, the type locality of *cinnamomea*; environmental conditions at the two places are similar. Compared with ten examples of *orolestes* from Teller, El Paso, and Chaffee counties, Colorado, these specimens are smaller, paler, and predominantly buffy rather than deep pinkish cinnamon, and the auditory bullae are more inflated. In their pallor and smallness they approach five specimens of *rupicola* from Washabaugh County, South Dakota, but they are more buffy, the bullae are less globose (nearer discoid), and the rostrum is longer and narrower (its greatest breadth about 42 percent of the greatest length of the nasals, compared with 44 percent in *rupicola*). Compared with eleven topotypes of *cinerea*, these Wyoming specimens are smaller and paler, the sphenopalatine vacuities larger (0.6 to 1.0 millimeter in width, compared with 0.3 to 0.6 millimeter in *cinerea*), the bullae more inflated, and the braincase relatively larger. Nineteen specimens at hand from Sublette County (Big Sandy) and Sweetwater County (one mile north of Linwood, Utah), Wyoming, and from localities south of Manila, Utah, on the northern slopes of the Uinta Range, are variously between *orolestes* and *cinerea* in characters of coloration, sphenopalatine vacuities, bullae and braincase, but in the sum of characters are slightly nearer *orolestes* and are referred to that race. The range of *cinnamomea* in southwestern Wyoming, thus, apparently is restricted to the arid lands between the principal mountain masses (Uinta and Wind River ranges). In the mountains it is replaced by the larger, darker, smaller-bullated *orolestes* or *cinerea*. The raising from synonymy of the name *cinnamomea* to apply to the bushy-tailed rats of southwestern Wyoming will bring to twelve the total of races of *Neotoma cinerea* that may be recognized (see Hooper, *loc. cit.*).

Independently and on the basis of differences in external characters only, Warren (The Mammals of Colorado. Univ. Oklahoma Press, 1942, p. 221) has recognized *cinnamomea* as a valid subspecies inhabiting parts of southwestern Wyoming and northwestern Colorado.—EMMET T. HOOPER, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

ANOTHER ARKANSAS ARMADILLO

The northward and eastward spread of the Texas nine-banded armadillo, *Dasypus novemcinctus mexicanus*, has been noted in several previous issues of the *Journal of Mammalogy* (Blair, vol. 17, pp. 293–294; Taber, vol. 20, pp. 489–493; and Dellinger and Black, vol. 21, pp. 190–191). On page one of the September 1, 1943, issue of the Fort Smith (Arkansas) Times Record there appeared a story of the capture of an armadillo on the farm of J. H. Robinson, east of Van Buren, Crawford County, Arkansas. The story was accompanied by an excellent photograph. The present record is neither as far north nor as far east as certain of the records reported by Dellinger and Black but it does add evidence that these records are based on a natural extension of range of the armadillo. This latest specimen appears to have been a wild animal and lends support to records and reports that the armadillo is becoming fairly well established in the Arkansas River Valley in Western Arkansas.—JOHN D. BLACK, *Wisconsin Conservation Department, Madison, Wisconsin.*

COMMENT AND NEWS

ERRATA

Through editorial oversight the figure numbers in the text of W. D. Crabb's "Growth, Development and Seasonal Weights of Spotted Skunks" in no. 3 of this volume do not agree with those in the legend for Plate 1. Text citations should read:

p. 214, line 5, (Plate 1, A, B) instead of (fig. 1).

p. 214, line 18, (Plate 1, C, D) instead of (fig. 2).

Also on p. 319 the heading "Comment and News" should appear just before the subhead "Letter to the Editor."

HALL MOVES TO KANSAS

Members of the Society may be interested to learn that Dr. E. Raymond Hall, our incumbent President, moved last July to Lawrence, Kansas, where he is now serving the University of Kansas as Head of the Department of Zoology and Director of the Museum of Natural History.

INDEX TO VOL. 25

The Society owes Dr. Donald Hoffmeister, University of Kansas Museum of Natural History, a vote of appreciation for preparing the index to the current volume of the Journal.

TWENTY-YEAR INDEX

Members of the Society and Subscribers to the Journal of Mammalogy can look forward to seeing the 20-year index of this Journal shortly. It is now in galley proof and should be available early next year. Miss Viola S. Schantz and her Index Committee deserve a citation for meritorious service to the Society in carrying forward an onerous task in the face of extreme difficulties.

HIGH COST OF PRINTING

Conditions brought on by the War have made it necessary for the printers to increase by 17 percent the cost of printing the Journal. Because of this, the number of pages we can print must be correspondingly reduced unless means can be found to augment our printing budget.

The Boston Society of Natural History has announced two prizes for the two most acceptable essays on mammals written in the English language. Each paper must be the result of original and unpublished research personally conducted by the author. Individuals interested may obtain the rules governing the contest by addressing their request to Boston Society of Natural History, 234 Berkeley Street, Boston 16, Massachusetts.

RECENT LITERATURE

(Conducted by Gerrit S. Miller, Jr., Remington Kellogg, and Emma M. Charters)

[Reprints of this section may be purchased for 18 cents each from the Corresponding Secretary.]

ALDOUS, CLARENCE M., and SHALER E. ALDOUS. The snowshoe hare—a serious enemy of forest plantations. Jour. Forestry, Washington, D. C., vol. 42, no. 2, pp. 88–94, illus. February, 1944.

ALLEE, W. C. (Review) Chimpanzees: A laboratory colony, by Robert M. Yerkes. Yale University Press, New Haven, 1943, 321 pp. Ecology, Lancaster, vol. 25, no. 1, pp. 122–123. January, 1944.

ANDERSON, R. M. A prior name revived for the bean mouse. Canadian Field-Nat., Sutton West, vol. 57, nos. 3–4, p. 92. April–May, 1943. (*Microtus pennsylvanicus insperatus* (Allen 1894), antedates *M. pennsylvanicus wahema* Bailey 1920.)

ANDERSON, R. M., and A. L. RAND. The long-tailed meadow mouse (*Microtus longicaudatus*) in Canada. Canadian Field-Nat., Sutton West, vol. 58, no. 1, pp. 19–21. January–February, 1944.

ANONYMOUS. Blackwater Refuge [Maryland] records first gray fox and skunk. Rally Sheet, League of Maryland Sportsmen, vol. 2, no. 1, p. 8. January, 1944.

——— Buffaloes coming to Georgia. Outdoor Georgia, Atlanta, vol. 12, no. 6, p. 3. January, 1944. (Buffaloes to be introduced from Washington to the "Coastal Flatwoods" section of Georgia.)

——— Deer conducts "blitz" on its old enemy—the coyote. Wyoming Wild Life, Cheyenne, vol. 9, no. 1, p. 9. January, 1944.

——— Education for the veterinary profession. Nature, London, vol. 153, no. 3871, pp. 35–38. January 8, 1944.

——— Fur animals of Texas. Texas Game and Fish, Austin, vol. 2, no. 2, pp. 13, 17, illus. January, 1944. (Skunks.)

——— Horned rabbit. Illinois Conservation, Springfield, vol. 9, no. 1, p. 37. Spring Issue, 1944.

——— Kill of deer in Maryland—season 1942 and at the Woodmont Rod and Gun Club. Maryland Conservationist, Baltimore, vol. 20, no. 1, pp. 1–2, 18–21, 29. Winter Issue, 1943.

——— Mad foxes. Alabama Conservation, Montgomery, vol. 15, no. 8, p. 14. February, 1944.

——— Moose observed on desert. Wyoming Wild Life, Cheyenne, vol. 8, no. 11, p. 23. November, 1943.

——— One in a thousand. Zoonooz, San Diego, vol. 17, no. 2, pp. 6–7, illus. February, 1944. (Black Saki monkey.)

——— Plague infection in California. U. S. Public Health Repts., Washington, D. C., vol. 58, no. 41, pp. 1528–1529. October 8, 1943.

——— Rabbits. Nat. Mag., Washington, D. C., vol. 37, no. 1, p. 53. January, 1944. (Diseases and parasites.)

——— Raw fur price trends in Ohio. Ohio Conserv. Bull., Columbus, vol. 8, no. 1, p. 12. January, 1944.

——— Release of 175 planned in deer restocking program. West Virginia Conservation, Charleston, vol. 7, no. 11, pp. 5, 16. February, 1944.

——— Signs in the snow. Field and Stream, New York, vol. 48, no. 10, pp. 22–23, illus. February, 1944. (Mink, rabbit, fox, opossum.)

——— The bushy-tailed wood rat, *Neotoma cinerea*. Wyoming Wild Life, Cheyenne, vol. 8, no. 12, pp. 12–14, illus. December, 1943.

ANSON, BARRY J. The early development of the membranous labyrinth in mammalian embryos, with special reference to the endolymphatic duct and the utriculo-endolymphatic duct. Anat. Rec., Philadelphia, vol. 59, no. 1, pp. 15–25, figs. 33. 1933.

ANSON, BARRY J., EARL W. CAULDWELL, and ARTHUR F. REIMANN. The human stapes: A noncomformist among bones. Quart. Bull., Northwestern Univ. Med. School, Chicago, vol. 18, no. 1, pp. 33–40, pls. 4. February, 1944.

AOKI, BUNICHIRO, SHINKICHI TATEISHI, RYO TANAKA, and KITAO FURUHATA. Anatomical notes on the dugong. Lab. Comp. Morph. and Mamm., Zool. Inst., Taihoku Imperial Univ., Taiwan, Japan, pp. 491–518, illus. 1938.

AUGUSTSON, G. F. Contributions from the Los Angeles-Museum Channel Islands Biological Survey No. 20. Three new fleas (Siphonaptera). Bull. Southern California Acad. Sci., Los Angeles, vol. 40, no. 2, pp. 101–107, illus. May–August, 1941.

——— A new flea from the Mohave Desert (California). Bull. Southern California Acad. Sci., Los Angeles, vol. 40, no. 3, pp. 138–139, 3 figs. September–December, 1941. (*Delotelis mohavensis* n. sp. from *Neotoma lepida*.)

——— Some new California Siphonaptera. Bull. Southern California Acad. Sci., Los Angeles, vol. 40, no. 3, pp. 140–146, 1 pl. September–December, 1941.

——— The allotype of *Geusibia ashcrafti* Augustson 1941. Bull. Southern California Acad. Sci., Los Angeles, vol. 40, no. 3, pp. 157–159, illus. September–December, 1941. (From *Ochotona schisticeps*.)

——— The allotype of *Amphipsylla neotomae* I. Fox, 1940. (Siphonaptera: Dolichopsyllidae.) Bull. Southern California Acad. Sci., Los Angeles, vol. 41, no. 1, pp. 39–41, illus. January–April, 1942. (From *Spilogale gracilis arizonae*.)

——— A new subspecies of Orchopeis sexdentatus (Baker). Bull. Southern California Acad. Sci., Los Angeles, vol. 42, no. 1, pp. 49–51, 1 pl. January–April, 1943. (From *Neotoma lepida devia*.)

——— A new parasitic fly from bats (Diptera: Pupipara). Bull. Southern California Acad. Sci., Los Angeles, vol. 42, no. 1, pp. 52–53, illus. January–April, 1943.

——— Preliminary records and discussion of some species of Siphonaptera from the Pacific southwest. Bull. Southern California Acad. Sci., Los Angeles, vol. 42, no. 2, pp. 69–89. May–August, 1943.

BAGLEY, LESTER. Who shall control our wild life? Wyoming Wild Life, Cheyenne, vol. 8, no. 11, pp. 1–10, illus. November, 1943.

BAHADURSINH. An interesting tiger shoot. Jour. Bombay Nat. Hist., vol. 44, no. 2, p. 291. December, 1943.

BAILEY, VERNON. Mouse plagues. A million mice a year from one pair provide an explanation of mouse plagues. Nature Magazine, Washington, D. C., vol. 37, no. 2, pp. 77–79, illus. February, 1944.

——— Mouse plagues are centuries old. South Dakota Conserv. Digest, Pierre, vol. 11, no. 2, pp. 2–3. February, 1944.

BARBOUR, THOMAS. The solenodons of Cuba. Proc. New England Zool. Club, Boston, vol. 23, pp. 1–8, pls. 3. March 7, 1944. (New: *Solenodon poeyanus*.)

BARRIE, SWEETEN, M. M. O. Vitamin E deficiency in the rat. V. Uterine changes in chronic deficiency. Biochemical Jour., Cambridge, England, vol. 37, no. 5, pp. 523–525. 1943.

BASSETT, CHARLES F. Substitutes in the fox and mink ration. Nat. Fur News, Denver, vol. 15, no. 12, pp. 11, 24. January, 1944.

BASSETT, CHARLES F., FORD WILKE, OLIVER PEARSON, and EDWARD MARTIN. Effect of mating time on productivity in foxes. National Fur News, Denver, vol. 15, no. 12, pp. 10, 26. January, 1944.

BATE, DOROTHEA M. A. Pleistocene *Cricetinae* from Palestine. Ann. and Mag. Nat. Hist., London, ser. 11, vol. 10, no. 72, pp. 813–838. December, 1943. (New: *Mesocricetus aramaeus*, *Allocricetus jezreelicus*, *Cricetulus demetros*.)

BEATON, LINDSAY E., and BARRY J. ANSON. The arterial supply of the small intestine. Quart. Bull., Northwestern Univ. Med. School, Chicago, vol. 16, no. 2, pp. 1–9. pls. 2. 1942.

BLACKFORD, JOHN L. Desert dwellers. Natural History, New York, vol. 53, no. 1, pp. 24–27, illus. January, 1944.

BLOODGOOD, KATE L. A wild rabbit meeting. Nat. Mag., Washington, D. C., vol. 37, no. 1, p. 51. January, 1944.

BRAGA, JOSE M. A Balaenoptera da praia do Paraiso. Bol. Assoc. Fil. Nat., Porto, vol. 1, no. 12, pp. 181–194, pls. 2. [Publ. Inst. Zool. "Augusto Nobre", Fac. Cienc. Porto.] July, 1940. (*Balaenoptera musculus*.)

BROOKS, ALLAN. Do predators eradicate disease? Rod and Gun in Canada, Montreal, vol. 45, no. 8, pp. 13, 29, illus. January, 1944.

BRYSON, VERNON. Spermatogenesis and fertility in Mus musculus as affected by factors at the T locus. Jour. Morph., Philadelphia, vol. 74, no. 1, pp. 131–187, illus. January, 1944.

BURKHER, PAULINE CHASTAIN. From the whale's mouth. Alaska Sportsman, Ketchikan, vol. 10, no. 2, pp. 14–15, 24, illus. February, 1944.

CAHALANE, VICTOR H. Practical application of mammalian population studies. Pennsylvania Game News, Harrisburg, vol. 14, no. 9, pp. 10–11. December, 1943.

CARHART, ARTHUR HAWTHORNE. The return of the fur brigade. Natural History, New York, vol. 53, no. 2, pp. 68–71, illus. February, 1944. (Beaver.)

CARR, MARION. The persistent callers. Jr. Nat. Hist. Mag., Amer. Mus. Nat. Hist., New York, pp. 4–7, pls. 5. January, 1944. (Deer.)

CARSON, LAWRENCE. A knock on the door. Alaska Sportsman, Ketchikan, vol. 9, no. 11, pp. 14–15, 28–35, illus. November, 1943. (Sea lions, seals.)

CARVALHO, JOSE C. M. The coccidia of wild rabbits of Iowa. I. Taxonomy and host-specificity. Iowa State College Jour. Sci., Ames, vol. 18, no. 1, pp. 103–135, illus. October, 1943.

——— The coccidia of wild rabbits of Iowa. II. Experimental studies with *Eimeria neoleporis* Carvalho, 1942. Iowa State College Jour. Sci., Ames, vol. 18, no. 2, pp. 177–189, illus. January, 1944.

CASTO, WILLIAM and CLIFFORD C. PRESNALL. Comparison of coyote trapping methods. Jour. Wildlife Manag., Menasha, vol. 8, no. 1, pp. 65–70. January, 1944.

CHASE, CPL. EARL, and PVT. RALPH DONAHUE. Report from the services. Pvt. Donahue finds plenty of life in the barren Aleutians. Animal Kingdom, New York, vol. 47, no. 1, pp. 11–13. January–February, 1944.

CLOE, WILLIAM E. The Illinois game harvest. Illinois Conservation, Springfield, vol. 8, no. 4, p. 19. Winter Issue, 1943.

COLE, LEON J., and RICHARD M. SHACKELFORD. White spotting in the fox. Amer. Fur Breeder, Duluth, vol. 16, no. 8, pp. 22, 24, figs. 4–5, February, 1944; no. 9, pp. 24–26, March, 1944.

——— White spotting in the fox. National Fur News, Denver, vol. 16, no. 1, pp. 11, 16, 19, 22, February, 1944; no. 3, pp. 8, 22, April, 1944; no. 4, p. 4, May, 1944.

COLLIAS, NICHOLAS E. Aggressive behavior among vertebrate animals. Physiological Zool., Chicago, vol. 17, no. 1, pp. 83–123. January, 1944.

COOK, DAVID B., and W. J. HAMILTON, JR. The ecological relationships of red fox food in eastern New York. Ecology, Lancaster, vol. 25, no. 1, pp. 91–104. January, 1944.

COUEY, FAYE. Golden eagle vs. bighorn sheep. Montana Wildlife Bull., Helena, vol. 1, no. 1, pp. 2–3, illus. January, 1944.

CRABB, WILFRED D. Ecology and management of the prairie spotted skunk *Spilogale interrupta* (Rafinesque), in southeastern Iowa. Iowa State College Jour. Sci., Ames, vol. 18, no. 1, pp. 22–24. October, 1943.

CROW, A. H. Observed at the grading table. National Fur News, Denver, vol. 15, no. 12, p. 9. January, 1944. (Fox.)

CURTIS, JAMES D. Appraisal of porcupine damage. Jour. Wildlife Manag., Menasha, vol. 8, no. 1, pp. 88–91. January, 1944.

DALKE, PAUL D., and DAVID L. SPENCER. Development and land use on a private game preserve in southern Taney County, Missouri. Jour. Wildlife Manag., Menasha, vol. 8, no. 1, pp. 1–6. Janaury, 1944.

DALMAT, HERBERT T. Paratyphoid infection in the northern white-footed mouse in central Iowa. Amer. Midland Nat., Notre Dame, vol. 31, no. 1, pp. 179–181. January, 1944.

DARSIE, J. C. The primitive opossum. North Carolina Wildlife Conserv., Raleigh, vol. 8, no. 1, pp. 10, 15. January, 1944.

DEGGELLER, CARL. Beitrag zur Kenntnis der Architektur des fetalen Hirnschädels. Zeitschr. f. Anat. u. Entwicklengsgesch., Berlin, vol. 111, no. 4, pp. 470–489, figs. 12. 1942.

DERANIYAGALA, P. E. P. The names of the elephants of Ceylon. Ann. and Mag. Nat. Hist., London, ser. 11, vol. 11, no. 73, pp. 61–64. January, 1944.

DE SHAZO, THELMA E. *Triatoma heidemanni* as a possible vector of relapsing fever. Amer. Jour. Med. Tech., Detroit, vol. 9, no. 3, pp. 75–81. May, 1943.

DORER, RICHARD J. How to attract wildlife. Conservation Volunteer, St. Paul, vol. 7, no. 38, pp. 14–18. January–February, 1944.

DOZIER, HERBERT L. Muskrat meat recipes. Ohio Conserv. Bull., Columbus, vol. 8, no. 1, pp. 4–5. January, 1944.

——— Muskrat investigations at the Blackwater National Wildlife Refuge, Maryland. Maryland Conservationist, Baltimore, vol. 21, no. 1, pp. 24–25, illus. Winter Issue, 1944.

DOZIER, HERBERT L., and HAROLD E. HALL. Observations on the Bryant fox squirrel. Maryland Conservationist, Baltimore, vol. 21, no. 1, pp. 2–7. Winter Issue, 1944.

DUCKWORTH, J., and W. GODDEN. The replenishment of depleted skeletal reserves of magnesium. Biochemical Jour., Cambridge, England, vol. 37, no. 5, pp. 595–598. 1943.

DUMOND, CLAIRE. Muskrat on the menu. Nature Mag., Washington, D. C., vol. 37, no. 2, pp. 80. 108. February, 1944.

EATES, K. R. A black panther shot in Sind. Jour. Bombay Nat. Hist. Soc., vol. 44, no. 2, pp. 291–292. December, 1943.

EICHER, GEORGE, JR. That thieving fox. Alaska Sportsman, Ketchikan, vol. 10, no. 1, pp. 14–15, 23–24, illus. January, 1944.

ENDICOTT, K. M., A. KORNBERG, and F. S. DAFT. Lesions in rats given sulfathiazole, sulfadiazine, sulfanilamide, sulfamerazine, sulfapyrazine, or acetysulfadiazine in purified diets. U. S. Public Health Repts., Washington, D. C., vol. 59, no. 2, pp. 49–54. January 14, 1944.

ESTRUCH, J. Osteologia comparada de los Auchenidos Peruanos. Revista Univ. Arequipa, Ano. 15, no. 18, pp. 113–157, illus. April–July, 1943.

FENSTERMACHER, R., O. WILFORD OLSEN, and B. S. POMEROY. Some diseases of white-tailed deer in Minnesota. Cornell Veterinarian, Ithaca, vol. 33, no. 4, pp. 323–332, 2 pls. October, 1943.

FULLER, ARTHUR B. Animal gliders. The Explorer, Cleveland, no. 77, pp. 6–7. January, 1944. (Popular account of flying squirrel.)

GIBLIN, N., and A. ALLEY. Studies in skull growth. Coronal suture fixation. Anat. Record, Philadelphia, vol. 88, no. 2, pp. 143–153, figs. 7. February, 1944. (Dog skulls.)

GILLETT, J. M. Ancestorless man: The anthropological dilemma. Scientific Monthly, Washington, D. C., vol. 57, no. 6, whole no. 339, pp. 533–545. December, 1943.

GOBLE, FRANS C., and ELLSWORTH C. DOUGHERTY. Notes on the lungworms (genus Protostrongylus) of varying hares (*Lepus americanus*) in eastern North America. Jour. Parasitology, Lancaster, vol. 29, no. 6, pp. 397–404, illus. December, 1943.

GRATER, RUSSELL K. Coyote foods near Boulder Dam. Jour. Wildlife Manag., Menasha, vol. 7, no. 4, pp. 422–423. October, 1943.

GREEN, R. G. Virulence of tularemia as related to animal and orthropod hosts. Amer. Jour. Hygiene, Baltimore, vol. 38, no. 3, pp. 282–292. November, 1943.

GREEN, R. G., C. A. EVANS, and C. L. LARSON. A ten-year population study of the rabbit

tick *Haemaphysalis leporis-palustris*. Amer. Jour. Hygiene, Baltimore, vol. 38, no. 3, pp. 260–281. November, 1943.

GREENLESS, STEPHEN. Moose in the muskeg. Rod and Gun in Canada, Montreal, vol. 45, no. 8, pp. 8–9, 22, illus. January, 1944.

GRIMM, WILLIAM. Wildlife conservation—Its past, present and future. Pennsylvania Game News, Harrisburg, vol. 14, no. 10, pp. 5, 27, 31. January, 1944.

HALDANE, J. B. S. Mutation and the rhesus reaction. Nature, London, vol. 153, no. 3873, p. 106. January 22, 1944.

HARRIS, WILLIAM P., JR. Additions and corrections to the section on Sciuridae in Ellerman's families and genera of living rodents. Occas. Papers Mus. Zool., Univ. Michigan, Ann Arbor, no. 484, pp. 21. April 17, 1944. (New: *Citellus pygmaeus ellermani* to replace *Citellus pygmaeus orlovi*.)

HEISER, JOSEPH M., JR. Recreation and wildlife conservation. Texas Game and Fish, Austin, vol. 2, no. 2, pp. 10, 18. January, 1944.

HEIZER, ROBERT F. Aconite poison whaling in Asia and America: An Aleutian transfer to the New World. Bur. American Ethnology, Washington, D. C., Bull. 153, Anthrop. Papers no. 24, pp. 415–468, pls. 18–23A. 1943.

HERMAN, CARLTON M. *Giardia* in the blood of a kangaroo rat. Jour. Parasitology, Lancaster, vol. 29, no. 6, p. 423. December, 1943.

———— Eye worm (*Thelazia californiensis*) infection in deer in California. California Fish and Game, San Francisco, vol. 30, no. 1, pp. 58–60. January, 1944.

HERMAN, CARLTON M., and HARRY A. JANKIEWICZ. Parasites of cottontail rabbits on the San Joaquin Experimental Range, California. Jour. Wildlife Manag., Menasha, vol. 7, no. 4, pp. 395–400. October, 1943.

HILL, JOHN ERIC. Rodent miners. Natural History, New York, vol. 53, no. 1, p. 21, illus. January, 1944.

HOLDUM, M. W. Coypu at Crescent, B. C. Canadian Field-Nat., Sutton-West, vol. 58, no. 1, p. 22. January–February, 1944. (*Myocastor coypus*.)

HOLT, ERNEST G., and WILLIAM R. VAN DERSAL. Wildlife and land use patterns. U. S. Dept. Agric., Misc. Publ. no. 444, pp. 1–73, illus. April, 1942.

HOOPER, EMMET T. San Francisco bay as a factor influencing speciation in rodents. Misc. Publ. Mus. Zool. Univ. Michigan, Ann Arbor, no. 59, pp. 1–89, pls. 5, maps 18. January 12, 1944.

HOPE, C. E. Studying owl pellets. Canadian Nature, Toronto, vol. 6, no. 1, pp. 22–23, illus. January–February, 1944.

HUMMON, O. J., and FRANCES R. BUSHNELL. Studies of cotton mink with reference to heredity and blood elements. National Fur News, Denver, vol. 15, no. 12, pp. 13, 22. January, 1944.

HUNTER, GILBERT N. The 1943 deer and elk situation. Colorado Conserv. Comments, Denver, vol. 6, no. 4, pp. 17–18. December 15, 1943.

JACKLEY, A. M. Badger, rattlesnake enemy, says expert. South Dakota Conserv. Digest, Pierre, vol. 11, no. 1, pp. 2–3, 16, illus. January, 1944.

JAEGER, ELLSWORTH. Little sachet. Canadian Nature, Toronto, vol. 6, no. 1, pp. 27–29, illus. January–February, 1944. (Skunk.)

JAMESON, E. W., JR. Notes on some fleas of New York State. Canadian Entomologist, Guelph, vol. 75, no. 9, p. 177. September, 1943.

JEFFERSON, R. N. Notes on the pine mouse. Virginia Fruit, Staunton, vol. 31, no. 5, pp. 10, 12. May, 1943.

JEPSEN, GLENN L. Phylogenetic trees. Trans. New York Acad. Sci., ser. 2, vol. 6, no. 3, pp. 81–92. January, 1944.

JONES, ARTHUR W. Protogynella blarinae n.g., n. sp., a new cestode from the shrew, *Blarina brevicauda* Say. Trans Amer. Microscopical Soc., Manhattan, vol. 62, no. 2, pp. 169–173. April, 1943.

JOYCE, C. R., and GAINES W. EDDY. A list of fleas (Siphonaptera) collected at Tama, Iowa.

Iowa State College Jour. Sci., Ames, vol. 18, no. 2, pp. 209–215. January, 1944. (Records of the hosts and a host index covering 18 species of mammals.)

KEITHAHN, E. L. The husky is much the larger breed. Alaska Sportsman, Ketchikan, vol. 9, no. 11, pp. 18–20, 23–24, illus. November, 1943.

KIMBALL, JAMES. Winter game trails. Outdoor Nebraska, Lincoln, vol. 21, no. 4, pp. 19–20. January, 1944.

KRUMBIEGEL, INGO. Die Säugetiere der Südamerika-Expeditionen Prof. Dr. Kriegs. Zool. Anz., Leipzig, vol. 137, nos. 1–2, pp. 18–29, figs. 7. January 15, 1942.

LAING, EDITH M. Llama, "Peruvian sheep." Nature Magazine, Washington, D. C., vol. 37, no. 1, p. 35. January, 1944.

LARRISON, EARL J. An early spring reconnaissance of the birds and mammals of Northrup Canyon, Upper Grand Coulee, Washington—Part I. Murrelet, Seattle, vol. 24, no. 3, pp. 35–46, September–December, 1943. [Actual date of publication, February 15, 1944.]

LATHAM, ROGER M. Our deer—past, present, and future. Pennsylvania Game News, Harrisburg, vol. 14, no. 9, pp. 4–5, 26–27, illus. December, 1943.

LEHMANN, VALGENE W. Lights in the night. Texas Game and Fish, Austin, vol. 2, no. 2, pp. 5, 15–17, illus. January, 1944. (Deer.)

LEISTER, CLAUDE W. Gorillas. The largest and most impressive of the manlike apes. New York Zool. Soc., Popular Ser. no. 4, pp. 7. 1944.

———— North American bears. They are called "The noblest of our carnivores." New York Zool. Soc., Popular Ser. no. 3, pp. 7. 1944.

LEOPOLD, ALDO. Home range. Wisconsin Conserv. Bull., Madison, vol. 8, no. 9, pp. 23–24. September, 1943.

LEOPOLD, A. S. Conservation of game. Missouri Conservationist, Jefferson City, vol. 5, no. 2, pp. 4–5, 14, illus. February, 1944.

LINCOLN, FREDERICK C. Wildlife management in the Americas. Agriculture in the Americas, U. S. Dept. Agric., Washington, D. C., vol. 4, no. 1, pp. 13–17. January, 1944.

LINSLEY, E. GORTON. Insect inhabitants of bird and mammal nests. Jour. Wildlife Manag., Menasha, vol. 7, no. 4, p. 423. October, 1943.

LOCKLEY, LT. A. S. Observation on the early autumn fauna of southern Alberta. Canadian Field-Nat., Sutton West, vol. 57, nos. 7–8, p. 132. October–November, 1943. (Antelope, coyotes, gophers, weasels.)

LOVERIDGE, ARTHUR. The aardvark and the armistice. Natural History, New York, vol. 53, no. 1, pp. 22–23, illus. January, 1944.

———— Banded mongooses as pets. Natural History, New York, vol. 53, no. 2, pp. 82–83, 96, illus. February, 1944.

LOYSTER, E. L. Winter deer food distribution. Wisconsin Conserv. Bull., Madison, vol. 9, no. 2, p. 5. February, 1944.

LUETH, FRANCIS X. The skunk. A discussion about a much cussed animal. Illinois Conservation, Springfield, vol. 8, no. 4, pp. 14–15, illus. Winter Issue, 1943.

LUTZ, H. J., and H. H. CHAPMAN. Injuries to young tree trunks from antler rubbing by deer. Jour. Wildlife Manag., Menasha, vol. 8, no. 1, pp. 80–81, pl. 5. January, 1944.

MALONEY, ALICE BAY. Fur brigade to the Bonaventura. John Work's California expedition of 1832–33 for the Hudson's Bay Company (continued). California Hist. Soc. Quart., San Francisco, vol. 22, no. 4, pp. 323–348. December, 1943.

MARCY, DONALD. Those bizarre animals from down under. Animal Kingdom, New York, vol. 47, no. 1, pp. 2–8, illus. January–February, 1944. (Kangaroos.)

MARSH, E. G., JR. Does the mountain lion scream? Colorado Conserv. Comments, Denver, vol. 6, no. 4, p. 14. December 15, 1943.

MATHER, DEANE W., ROBERT H. GENSCH, and H. ALLEN BARTON. Report on the snowshoe hare repellent and poison studies conducted on the Nicolet National Forest in 1941 and 1942. U. S. Forest Service, Washington, D. C., 36 pp., illus. 1943.

MAUNDER, MARGARET. Deer hunting with bow and arrow. Minnesota Sportsman's Digest, Minneapolis, vol. 4, no. 4, pp. 4, 9–11. December, 1943. (Two does killed near Hayward, Wisconsin.)

MCGREW, PAUL O. An early Pleistocene (Blancan) fauna from Nebraska. Chicago Nat. Hist. Mus., Publ. 546, Geol. Ser. vol. 9, no. 2, 37 pp., illus. January 20, 1944.

MCMAHON, MARGARET C. Susceptibility of the golden hamster, *Mesocricetus auratus*, to plague. U. S. Pub. Health Repts., Washington, D. C., vol. 59, no. 7, pp. 234–236. February 18, 1944.

MERRITTS, HELEN V. Quills. Pennsylvania Game News, Harrisburg, vol. 14, no. 10, p. 25, illus. January, 1944.

MOHLER, LEVI L. Furs from farm and ranch. Outdoor Nebraska, Lincoln, vol. 21, no. 4, p. 17. January, 1944.

MOHR, ERNA. Geschlechtsunterschiede am Walross-Schädel. Zool. Anz., Leipzig, vol. 137, nos. 5–6, pp. 71–76, figs. 5. February 15, 1943. (*Odobaenus rosmarus*.)

MOORE, JOSEPH C. A contribution to the natural history of the Florida short-tailed shrew. Proc. Florida Acad. Sci., vol. 6, nos. 3–4, pp. 155–166. December, 1943.

MOORE, GEORGE C. White-tails in Alabama. Alabama Conservation, Montgomery, vol. 15, no. 8, pp. 8–9, 12, 14, illus. February, 1944.

NAGEL, W. O. Wildlife prepares for winter. Missouri Conservationist, Jefferson City, vol. 5, no. 1, pp. 4–5, 14–15, illus. January, 1944.

NORTH, F. J. Paviland cave, the "Red Lady," the deluge, and William Buckland. Ann. Sci., London, vol. 5, no. 2, pp. 91–128, figs. 2. December, 1942.

OBERHOLSER, HARRY C. Organizations and officials concerned with wildlife protection: 1942. U. S. Dept. Interior, Fish and Wildlife Serv., Circ. no. 5, pp. 25. April, 1943.

OLSEN, ORANGE A. Big game in multiple land use in Utah. Jour. Forestry, Washington, D. C., vol. 41, no. 11, pp. 792–797. November, 1943.

——— Elk below! Taking a winter census of the Jackson Hole herd from the air is a tough but exciting job. American Forests, Washington, D. C., vol. 50, no. 2, pp. 65–67, 94, illus. February, 1944.

——— Big game in multiple land use in Utah. Wisconsin Conserv. Bull., Madison, vol. 9, no. 2, pp. 11–16. February, 1944.

OSBORN, BEN, and W. H. KELLOGG. Wildlife occurrence and habitat conditions in Rober Mills and Custer Counties, Oklahoma. Proc. Oklahoma Acad. Sci., Guthrie, vol. 33, pp. 41–44. 1943.

PEARSON, OLIVER P. and ROBERT K. ENDERS. Time of ovulation and fertilization in the fox. American Fur Breeder, Denver, vol. 16, no. 7, pp. 32–34, figs. 1. January, 1944.

——— Duration of pregnancy in certain mustelids. Jour. Exper. Zool., Philadelphia, vol. 95, no. 1, pp. 21–35. February, 1944.

PEREZ-LLANO, GEORGE A. Lichens—their biological and economic significance. Botanical Review, Lancaster, vol. 10, no. 1, pp. 1–65. January, 1944.

PERKINS, R. MARLIN. Animal faces. Foster and Stewart, Buffalo, N. Y., pp. 93, illus. 1944.

POCOCK, R. I. The larger deer of British India. Part IV. The chital (*Axis*) and the hog-deer (*Hyelaphus*). Jour. Bombay Nat. Hist. Soc., vol. 44, no. 2, pp. 169–178, figs. 4–8. December, 1943.

——— The wild cat (Felis lybica) of northern Benguella, Angola. Ann. and Mag. Nat. Hist., London, ser. 11, vol. 11, no. 74, pp. 130–133. February, 1944. (New: *Felis lybica pyrrhus*.)

——— The wild cat (Felis lybica) of Palestine. Ann. and Mag. Nat. Hist., London, ser. 11, vol. 11, no. 74, pp. 125–130. February, 1944. (New: *Felis lybica tristrami*.)

POOLE, EARL L. Predators on a game refuge. Pennsylvania Game News, Harrisburg, vol. 14, no. 10, pp. 10–13, illus. January, 1944.

PRIAULX, ARTHUR. The Boomer—a woodland tojo. American Forests, Washington, D. C., vol. 50, no. 1, pp. 22–23, photos. 3. January, 1944. (Mountain beaver.)

QUICK, H. F. Habits and economics of the New York weasel in Michigan. Jour. Wildlife Manag., Menasha, vol. 8, no. 1, pp. 71–78, pl. 4. January, 1944.

ROBERTS, RUSSEL, and OTHERS. Who—me? [Koala, fox, hamster, lemur, tiger.] Natural History, New York, vol. 53, no. 1, pp. 44–47, photographs. January, 1944.

ROBEY, GEORGE. A quick look at deer in Roosevelt Game Area. Ohio Conserv. Bull., Columbus, vol. 8, no. 1, pp. 16–17, 25, illus. January, 1944.

RUTLEDGE, ARCHIBALD. Sentinels of the wild. Field and Stream, New York, vol. 48, no. 10, pp. 26–27, 85, illus. February, 1944. (Deer, beaver.)

SCOTT, THOS. G. Some food coactions of the northern plains red fox. Ecol. Monographs, Durham, vol. 13, no. 4, pp. 427–479, illus. October, 1943.

SCOTT, W. E. Does inbreeding cause the cycle on game animals? Wisconsin Conserv. Bull., Madison, vol. 9, no. 2, pp. 6–10. February, 1944.

SEALANDER, JOHN A. Winter food habits of mink in southern Michigan. Jour. Wildlife Manag., Menasha, vol. 7, no. 4, pp. 411–417. October, 1943.

SEVERAID, JOYE HAROLD. The snowshoe hare. Its life history and artificial propagation. Maine Dept. Inland Fisheries and Game, Augusta, pp. 95, pls. 9. 1942.

SHERMAN, H. B. The armadillo in Florida. Florida Entomologist, Gainesville, vol. 26, no. 4, pp. 54–59. December, 1943.

SICHER, HARRY. Masticatory apparatus in the giant panda and the bears. Zool. Ser. Field Mus. Nat. Hist., Chicago, vol. 29, no. 4, pp. 61–73, figs. 13–17. January 28, 1944.

SMOKEY, GEORGE. Rats. South Dakota Conserv. Digest, Pierre, vol. 11, no. 1, pp. 10, 16. January, 1944.

———— Weasels. South Dakota Conserv. Digest, Pierre, vol. 11, no. 2, pp. 7, 11. February, 1944.

SNOW, HOMER F. Wallaroos, mountain cousins. Nature Magazine, Washington, D. C., vol. 37, no. 1, pp. 20–21, 50, illus. January, 1944.

SPEER, OTIS H. A foot in a trap—a head in a snare. Alaska Sportsman, Ketchikan, vol. 10, no. 1, pp. 12–13, 28–29, illus. January, 1944. (Wolf.)

SPRIGGS, JAMES W. Steel-trapping the beaver. Wyoming Wild Life, Cheyenne, vol. 9, no. 1, pp. 1–4, illus. January, 1944.

STEINHAUS, EDWARD A., R. R. PARKER, and MAX T. MCKEE. Cultivation of *Pasteurella tularensis* in a liquid medium. Publ. Health Repts., Washington, D. C., vol. 59, no. 3, pp. 78–79. January 21, 1944.

STEPHENSON, J. H. No closed season on fox. Michigan Conserv., Lansing, vol. 12, no. 10, pp. 3, 11. December, 1943.

STEVENS, ROSS O. Talk about wildlife for hunters, fisherman and nature lovers. Bynum Printing Co., Raleigh, N. C., 229 pp. 1944.

TAKOS, MICHAEL J. Trapping and banding muskrats. Jour. Wildlife Manag., Menasha, vol. 7, no. 4, pp. 400–407, pls. 24–25. October, 1943.

TAYLOR, WALTER P. Conservation and war. Nature Magazine, Washington, D. C., vol. 37, no. 1, pp. 40–43, illus. January, 1944.

TAYLOR, WALTER P., and DANIEL W. LAY. Ecologic niches occupied by rabbits in eastern Texas. Ecology, Lancaster, vol. 25, no. 1, pp. 120–121. January, 1944.

THOM, W. S. A few notes about the five rhinoceros of the world. Jour. Bombay Nat. Hist. Soc., vol. 44, no. 2, pp. 257–274. December, 1943.

THOMAS, GAIL M., and WARREN J. ALFRED. Mass trapping of mule deer. Jour. Wildlife Manag., Menasha, vol. 7, no. 4, pp. 407–411. October, 1943.

TORRISON, MANDT. Many factors determine ownership of wildlife. West Virginia Conservation, Charleston, vol. 7, no. 10, pp. 17–20. January, 1944.

TRUMP, RICHARD F., and GEORGE O. HENDRICKSON. Methods for trapping and tagging woodchucks. Jour. Wildlife Manag., Menasha, vol. 7, no. 4, pp. 420–421. October, 1943.

UVAROV, B. P. Fluctuation in animal populations. Nature, London, vol. 153, no. 3872, pp. 66–67. January 15, 1944.

VASARHELYI, STEPHAN. Mustela hungarica nov. spec., eine neue Wieselart der ungarischen Säugetierfauna. Zool. Anz., Leipzig, vol. 137, nos. 11–12, pp. 221–226, figs. 3. April 1, 1942. (New: *Mustela hungarica*.)

VAUGHN, ERNEST A. Food habit study of Maryland raccoons. Maryland Conservationist, Baltimore, vol. 21, no. 1, pp. 26–28. Winter Issue, 1944.

VON BLOEKER, JACK C. A new shrew from Santa Catalina Island, California. Bull. Southern California Acad. Sci., Los Angeles, vol. 40, no. 3, pp. 163–164. September–December, 1941. (New: *Sorex willetti*.)

WATSON, D. M. S. (Review) A monograph on the discovery, evolution, migration and extinction of the mastodonts and elephants of the World, by Prof. Henry Fairfield Osborn, vol. 2, 1942. Stegodontoidea, Elephantoidea. Nature, London, vol. 153, no. 3870, pp. 5–7. January 1, 1944.

WENRICH, D. H. Morphology of the intestinal trichomonad flagellates in man and of similar forms in monkeys, cats, dogs, and rats. Jour. Morph., Philadelphia, vol. 74, no. 1, pp. 189–211, illus. January, 1944.

WEYMOUTH, F. W., J. M. CRISMON, V. E. HALL, H. S. BELDING, and JOHN FIELD, 2D. Total and tissue respiration in relation to body weight: A comparison of the kelp crab with other crustaceans and with mammals. Physiological Zool., Chicago, vol. 17, no. 1, pp. 50–71. January, 1944.

WHITTINGTON DOROTHY. Clowns of the sea. Fauna, Philadelphia, vol. 4, no. 3, pp. 76–78, illus. September, 1943. (Dolphins.)

WOOD, SHERWIN F. Observations on vectors of Chagas' disease in the United States. II. Arizona. American Jour. Tropical Med., Baltimore, vol. 23, no. 3, pp. 315–320. May, 1943.

WOODSIDE, A. M., R. N. JEFFERSON, R. C. MOORE, and E. H. GLASS. Control of field mice in apple orchards. Virginia Agric. Expt. Sta., Blacksburg, Bull. 344, pp. 1–16, illus. 1942.

YEAGER, LEE E., and HARRY G. ANDERSON. Some effects of flooding and waterfowl concentration on mammals of a refuge area in central Illinois. Amer. Midland Nat., Notre Dame, vol. 31, no. 1, pp. 159–181, figs. 2. January, 1944.

YEATTER, RALPH E., and DAVID H. THOMPSON. Cottontails, tularemia and weather. Illinois Conservation, Springfield, vol. 8, no. 4, pp. 6–7, 36, illus. Winter Issue, 1943.

YERKES, ROBERT M. Chimpanzees. A laboratory colony. Yale Univ. Press, New Haven, pp. xv + 321, 63 pls. 1943.

YOUNG, STANLEY P. What was the early Indian dog? American Forests, Washington, D. C., vol. 50, no. 1, pp. 26–29, 32, 45, photos. 4. January, 1944.

ZUCKERMAN, S. Life and mentality of the chimpanzee. Nature, London, vol. 153, no. 3872, pp. 65–66. January 15, 1944.

OBITUARY NOTICE

PETER EMMET CROWE

1921–1944

Lieut. Peter E. Crowe, a member of the Society since 1940, was killed in action May 23 while on a mission over Europe. He had recently been promoted to First Lieutenant and awarded the Air Medal for "courage, coolness and skill," as the accompanying citation read, displayed on five combat missions. Those of us who knew him realize that this citation describes his behavior in any crisis.

Lieut. Crowe was born in New York City, February 19, 1921. Much of his early life was spent on Staten Island where some native fauna and flora still persists. As a boy he became interested in vertebrate and insect life, started collecting and preparing specimens, many of which went to the Staten Island Zoological Society's collection. He began his contact with the American Museum when he brought specimens to compare with material here in the summer of 1937. From then on he was a frequent visitor to the Department of Mammals.

In the summer of 1938 he and Robert Edwards (now Captain, Army Air Force) collected near Lakeside, New Jersey; most of the mammals they procured came eventually to the Museum. Even at this period Peter Crowe prepared his specimens extremely well and kept extensive notes of field observations. The next summer he went with a party from the Museum to the Big Bend Region of Texas, where several months were spent collecting. The two summers following, Peter Crowe went with other Museum expeditions, the last one being to the southern Canadian Rockies. The collection from this expedition, together with other material from this region he studied in the summer of 1942, writing a report on the mammals of the area which was published in the Bulletin of the American Museum of Natural History, volume 80. Weekends and vacations during the college year, he collected and marked bats for a study of home range and homing. Several short papers were written on results of this work. His studies showed a maturity of mind and broad interest that promised a great future in his chosen field.

Peter Crowe was graduated from Cornell University the summer of 1942 and shortly thereafter was inducted into the Army. He was assigned for training as a pilot and showed an aptitude for flying that was highly regarded by his officers. Last September he graduated and was commissioned at the Advanced Flying School, Stockton, California. Since March of this year he had been stationed in England, pilot of a Flying Fortress.—JOHN ERIC HILL.

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